AC 29/4/2013 Item No. 4.73

UNIVERSITY OF MUMBAI

Revised Syllabus

Program- Bachelor of Engineering

Course- Civil Engineering

(Second Year – Sem. III & IV)

Under

FACULTY OF TECHNOLOGY

(As per Credit Based Semester and Grading System from 2013-14)

From Dean's Desk:

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education.The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

Faculty of Technology, University of Mumbai, in one of its meeting unanimously resolved that, each Board of Studies shall prepare some Program Educational Objectives (PEO's) and give freedom to affiliated Institutes to add few (PEO's) and course objectives and course outcomes to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth and approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges and experts from industry to be involved while revising the curriculum. I am happy to state that, each Board of studies has adhered to the resolutions passed by Faculty of Technology, and developed curriculum accordingly. In addition to outcome based education, semester based credit and grading system is also introduced to ensure quality of engineering education.

Semester based Credit and Grading system enables a much-required shift in focus from teacher-centric to learner-centric education since the workload estimated is based on the investment of time in learning and not in teaching. It also focuses on continuous evaluation which will enhance the quality of education. University of Mumbai has taken a lead in implementing the system through its affiliated Institutes and Faculty of Technology has devised a transparent credit assignment policy and adopted ten points scale to grade learner's performance.Credit assignment for courses is based on 15 weeks teaching learning process, however content of courses is to be taught in 12-13 weeks and remaining 3-2 weeks to be utilized for revision, guest lectures, coverage of content beyond syllabus etc.

Credit and grading based system was implemented for First Year of Engineering from the academic year 2012-2013. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2013-2014, for Third Year and Final Year Engineering in the academic years 2014-2015 and 2015-2016 respectively.

Dr. S. K. Ukarande
Dean,
Faculty of Technology,
Member - Management Council, Senate, Academic Council
University of Mumbai, Mumbai

Preamble

The engineering education in India in general is expanding in manifolds. Now, the challenge is to ensure its quality to the stakeholders along with the expansion. To meet this challenge, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education and reflects the fact that in achieving recognition, the institution or program of study is committed and open to external review to meet certain minimum specified standards. The major emphasis of this accreditation process is to measure the outcomes of the program that is being accredited. Program outcomes are essentially a range of skills and knowledge that a student will have at the time of graduation from the program. In line with this Faculty of Technology of University of Mumbai has taken a lead in incorporating philosophy of outcome based education in the process of curriculum development.

I am happy to state here that, Program Educational Objectives were finalized in a meeting where syllabus committee members were also present. The Program Educational Objectives finalized for undergraduate program in civil Engineering are as follows:

1. To prepare Learner's with a sound foundation in the mathematical, scientific and engineering fundamentals
2. To prepare Learner's to use effectively modern tools to solve real life problems
3. To prepare Learner's for successful career in Indian and Multinational Organisations and to excel in Postgraduate studies
4. To encourage and motivate Learner's for self-learning
5. To inculcate professional and ethical attitude, good leadership qualities and commitment to social responsibilities in the Learner's

In addition to above each institute is free to add few (2 to 3) more Program Educational Objectives of their own. In addition to Program Educational Objectives, course objectives and expected course outcomes from learner's point of view are also included in the curriculum for each course of undergraduate program to support the philosophy of outcome based education. I believe strongly that small step taken in right direction will definitely help in providing quality education to the stake holders.

Dr. S. K. Ukarande
Chairman, Board of studies in Civil Engineering
University of Mumbai, Mumbai

University of Mumbai

Scheme of Instructions and Examination

Second Year Engineering (Civil Engineering)

(With Effect from 2013-2014)

Semester III

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Pract.	Tut.	Total
CE-C301	Applied Mathematics-III*	4	--	--	4	--	--	4
CE-C302	Surveying – I	3	2	--	3	1	--	4
CE-C303	Strength of Materials	4	2	--	4	1	--	5
CE-C304	Building Materials and Construction	3	2	--	3	1	--	4
CE-C305	Engineering Geology	3	2	--	3	1	--	4
CE-C306	Fluid Mechanics – I	3	2	--	3	1		4
CE-C307	Database and Information Retrieval System*	--	4‡	--	--	2	--	2
Total		**20**	**15**	--	**20**	7	--	**27**

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-C301	Applied Mathematics-III*	20	20	20	80	3	--	--	--	100
CE-C302	Surveying – I	20	20	20	80	3	25	--	25	150
CE-C303	Strength of Materials	20	20	20	80	3	25	--	25	150
CE-C304	Building Materials and Construction	20	20	20	80	3	25	--	25	150
CE-C305	Engineering Geology	20	20	20	80	3	25	--	25	150
CE-C306	Fluid Mechanics – I	20	20	20	80	3	25	--	--	125
CE-C307	Database and Information Retrieval System*	--	--	--	--	--	25	25		50
Total		**120**	**120**	**120**	**480**	--	**150**	**25**	**100**	**875**

‡ For the subject 'Database and Information Retrieval System' although 4 (Four) clock hours are mentioned under the head of Practical, 2 (Two) clock hours out of these 4 (Four) clock hours may be utilized as the Theory at the Institute/ College level to impart the theoretical aspects of the said subject; and accordingly, provision may be made in the Time Table. * Course common for Civil Mechanical, Automobile & Production Engineering.

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 III

Subject Code	Subject Name	Credits
CE-C 301	Applied Mathematics-III	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 develop in the students the skills essential 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. The course deals with the topics such as Laplace Transform, Complex Variables, Fourier Series and Partial Differential Equations.

Objectives

- To provide students with a sound foundation in the mathematical fundamentals necessary to formulate, solve and analyze engineering problems.
- The make the students understand the basic principles of Laplace Transform, Fourier series, Complex Variables.

Detailed Syllabus

Module	Sub-Modules/ Contents		Periods
I.	**1. Laplace Transform**		**5**
	1.1	Function of bounded variation, Laplace Transform of standard functions such as 1, t^n, e^{at}, $\sin at$, $\cos at$, $\sinh at$, $\cosh at$	

	1.2	Linearity property of Laplace Transform, First Shifting property, Second Shifting property, Change of Scale property of L.T., $L\{t^n f(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\left\{\frac{d^n f(t)}{dt^n}\right\}$ (without proof) Heaviside Unitstep function, Direct Delta function, Periodic functions and their Laplace Transform	
II.	**2. Inverse Laplace Transform**		**5**
	2.1	Inverse Laplace Transform: Linearity property, use of theorems to find inverse Laplace Transform, Partial fractions method and convolution theorem (without proof).	
	2.2	Applications to solve initial and boundary value problems involving ordinary differential equations with one dependent variable.	
III.	**Complex variables**		**10**
	3.1	Functions of complex variable, Analytic function, necessary and sufficient conditions for $f(z)$ to be analytic (without proof), Cauchy-Riemann equations inpolar coordinates.	
	3.2	Milne- Thomson method to determine analytic function $f(z)$ when it's real or imaginary or its combination is given. Harmonic function, orthogonal trajectories.	
	3.3	Mapping: Conformal mapping, linear, bilinear mapping, cross ratio, fixed points and standard transformations such as Rotation and magnification, inversion and reflection, translation.	
IV.	**4. Complex Integration**		**10**
	4.1	Line integral of a function of a complex variable, Cauchy's theorem for analytic function, Cauchy's Goursat theorem (without proof), properties of line integral, Cauchy's integral formula and deductions.	
	4.2	Singularities and poles:	
	4.3	Taylor's and Laurent's series development (without proof)	
	4.4	Residue at isolated singularity and its evaluation.	
	4.5	Residue theorem, application to evaluate real integral of type $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$, & $\int_{-\infty}^{\infty} f(x)\, dx$	
V.	**5. Fourier Series**		**10**
	5.1	Orthogonal and orthonormal functions, Expressions of a function in a series of orthogonal functions, Dirichlet's conditions, Fourier series of periodic	

		function with period2π & $2l$.	
	5.2	Dirichlet's theorem(only statement), even and odd functions, Half range sine and cosine series, Parsvel's identities (without proof)	
	5.3	Complex form of Fourier series.	
VI.	**6. Partial Differential Equations**		**12**
	6.1	Numerical Solution of Partial differential equations using Bender Schmidt Explicit Method, Implicit method (Crank- Nicolson method) Successive over relaxation method.	
	6.2	Partial differential equations governing transverse vibrations of elastic string its solution using Fourier series.	
	6.3	Heat equation, steady-state configuration for heat flow.	
	6.4	Two and Three dimensional Laplace equations.	

Contribution to Outcomes

On successful completion of this course, the students will be able to:

- Demonstrate the ability of using Laplace Transform and Fourier Series in solving the Ordinary Differential Equations and Partial Differential Equations.
- Identify the analytic function, harmonic function, orthogonal trajectories and to apply bilinear transformations and conformal mappings.
- Identify the applicability of theorems and evaluate the contour integrals.

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 solved.

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. Elements of Applied Mathematics: *P N Wartikar and J N Wartikar*; Pune Vidyarthi Griha Prakashan.
2. Higher Engineering Mathematics: *Dr B. S. Grewal*; Khanna Publications.
3. Advanced Engineering Mathematics: *E Kreyszing*, Wiley Eastern Limited.

Reference Books:

1. Complex Variables: *Churchill*, Tata Mc-Graw Hill Publications
2. Numerical Methods: *Kandasamy*
3. Integral Transforms and their Engineering Applications, Dr B. B. Singh, Synergy Knowledgeware, Mumbai

Semester III

Subject Code	Subject Name	Credits
CE- C 302	Surveying -I	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

Surveying is a core subject for civil engineers. It is the first step towards all civil engineering projects. A good surveyor is an asset to the company, organization or establishment. All the civil engineering projects such as buildings, transportation systems including roads, bridges, railways, airports along with dams and water/ sewage treatment plants start with surveying as the basic operations. Hence, the knowledge of surveying is very essential to all the civil engineering professionals. In this subject, the students get acquainted with the basic methods and equipments that are used in surveying and it helps them to produce plans and sections. It is also useful in setting out civil engineering structures on construction sites.

Objectives

Students will be able to:

- Apply principles of surveying and levelling for civil engineering works
- Use the appropriate methods of surveying.
- Perform various projects using different instruments skillfully.
- Take linear and angular measurements.
- Record the data in field book.
- Draw the plans and sections.
- Compute areas and volumes.

Detailed Syllabus

Module	Sub-Modules/ Contents		Periods
1.	**Introduction**		**05**
	1.1	Definition, principles, object, uses and necessity of surveying. Various types of surveying– based on methods and instruments, classifications-Plane surveying and geodetic surveying, Scales, Plain and diagonal scale, use of various types of verniers and micrometers in survey instruments.	
	1.2	Chain surveying, study of ranging, Instruments required for linear measurements and setting out right angles.	
2.	**Levelling**		**10**
	2.1	Definitions, technical terms, principle of levelling, different types of levels such as dumpy, tilting, wye level, auto level and laser level, temporary and permanent adjustments of level	
	2.2	Levelling staff – Different types, classification of levelling, reduction of levels. Precise level and levelling staff, and field procedure for precise levelling. Difficulties in levelling work, corrections and precautions in levelling work, problems, corrections due to curvature and refraction.	
3.	**Contouring**		**03**
	3.1	Contouring: definitions, contour interval, equivalent, uses and characteristics of contour lines, direct and indirect methods of contouring. Grade contour: definition and use.	
	3.2	Computation of volume by trapezoidal and prismoidal formula, volume from spot levels, volume from contour plans.	
4.	**Traversing**		**13**
	4.1	Compass survey: Bearings: Definition, different types and designations, compass- prismatic and surveyor's, declination, local attraction, plotting of compass survey by different methods.	
	4.2	Theodolite traverse: Various parts and axis of transit, technical terms, temporary and permanent adjustments of a transit, horizontal and vertical angles, methods of repetition and reiteration.	
	4.3	Different methods of running a theodolite traverse, Gales traverse table,	

		balancing of traverse by Bow- Ditch's, transit and modified transit rules	
	4.4	Problems on one plane and two plane methods, omitted measurements, Precautions in using transit, errors in theodolite traversing; Use of theodolite for various works such as prolongation of a straight line, setting out an angle, bearing measurements.	
5.	**Areas**		**04**
	5.1	Area of a irregular figure by trapezoidal rule, average ordinate rule, Simpson's 1/3 rule, various coordinate methods.	
	5.2	Planimeter: types including digital planimeter, area of zero circle, use of planimeter.	
6.	**Plane Table Surveying**		**04**
	6.1	Definition, uses and advantages , temporary adjustments	
	6.2	Different methods of plane table surveying	
	6.3	Errors in plane table surveying	
	6.4	Use of telescopic alidade	

Contribution to Outcomes

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

- Take linear and angular measurements
- Record the various measurements in the field book
- Find the areas of irregular figures.
- Prepare the plans and sections required for civil engineering projects.

The successful completion of the course shall equip the students to undertake the course Surveying-II.

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 solved.

Oral Examination:

The oral examination shall be based on the entire syllabus and the term work.

List of Practicals:

1. Chaining Ranging and offsetting.
2. Measuring Bearing of survey lines using Prismatic compass.
3. Measuring bearing of survey lines using Surveyor's compass.
4. Measurement of horizontal angle by Repetition Method.
5. Measurement of horizontal angle by Reiteration Method.
6. Measurement of vertical Angle using theodolite.
7. Determination of R.L of points using Auto level and Dumpy level.
8. Determination of areas of irregular figures by planimeter.
9. Plane table surveying by various methods.

Term work: It shall consist of the following:

1. Field book submission on afore-mentioned practicals conducted on and off the field.
2. Drawing sheets of a three day projects on compass / theodolite traversing and plane table surveying.
3. 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 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.-I): *Dr. B.C. Punmia,* Laxmi Publications.
7. Surveying and Levelling (Vol.-I):*S. K.Duggal,* Tata Mc-Graw Hill

Semester III

Subject Code	Subject Name	Credits
CE-C 303	Strength of Materials	4

Teaching Scheme

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorials	Total
04	02	-	04	01	-	05

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 different types of structures made up of different materials such as concrete, steel, metals and timber. They are subjected to various types of loading/ forces such as axial, shear, bending and torsion. This subject equips the students to analyze the internal behavior of material of the structural members under different types of loading. The knowledge gained in this subject is helpful to study other subjects like Structural Analysis and Structural Design.

Objectives

- To study the engineering properties of the materials and solids and analyze the same to evaluate the stress –strain behaviour.
- To analyze the internal forces for the statistically determinate and compound beams having internal hinges with different types of loading.
- To understand the concept and behaviour of flexural members (beams) in flexure and shear, solid circular shaft for tension, thin shells for internal stresses.
- To introduce the concept of strain energy for axial, flexure, shear and torsion.
- To study the behaviour of axially loaded columns using different theories available for the analysis with various end conditions.

Detailed Syllabus

Module	Sub-Modules/ Contents		Periods
I.	**1. Shear Force and Bending Moment in Beams**		**07**
	1.1	Axial force, shear force and bending moment diagrams for statically determinate beams including beams with internal hinges for different types of loading.	
	1.2	Relationship between rate of loading, shear force and bending moment.	
II.	**2. Stresses and Strains**		**07**
	2.1	Stresses, Strains, Modulus of elasticity (E), Modulus of rigidity (G), Bulk Modulus (K), Yield Stresses, Ultimate Stress, Factor of safety, shear stress, Poisson's ratio.	
	2.2	Relationship between E, G and K, bars of varying sections, deformation due to self weight, composite sections, temperature stress.	
III.	**3. Theory of Simple Bending**		**06**
	Flexure formula for straight beam, moment of inertia, transfer theorem, polar moment of inertia, simple problems involving application of flexure formula, section modulus, moment of resistance, flitched beams.		
	4. Strain Energy		**03**
	Strain energy due to axial force, stresses in axial member and simple beams under impact loading.		
IV.	**5. Shear Stresses in Beams**		**06**
	Distribution of shear stress across plane sections commonly used for structural purposes, shear connectors.		
	6. Theory of Simple Torsion		**06**
	Torsion in circular shafts-solid & hallow, stresses in shaft when transmitting power, closed coil helical spring under axial load		
V.	**7. Direct and Bending Stresses**		**06**
	Application to member's subjected to eccentric loads, core of section, problems on chimneys, retaining walls etc involving lateral loads.		
	8. Struts		**03**
	Struts subjected to axial loading, concept of buckling, Euler's formula for struts with different support conditions, limitation, Euler's and Rankine's design formulae.		

VI	**9. Principal Planes and Stresses**		**05**
	9.1	General equation for transformation of stress, principal planes and principal stresses, maximum shear stress, stress determination using Mohr's circle,	
	9.2	Principal stresses in shafts subjected to combined torsion, bending & axial thrust, and concept of equivalent torsional and bending moment.	
	10. Thin Cylindrical and Spherical Shells		
	Cylindrical and spherical shells under internal pressure.		**03**

Contribution to Outcomes

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

- Understand and determine the engineering properties for metals and non metals.
- Understand the concepts of shear force, bending moment, axial force for statically determinate beams and compound beams having internal hinges; and subsequently, its application to draw the shear force, bending moment and axial force diagrams.
- Analyze the flexural members for its structural behaviour under the effect of flexure (bending), shear and torsion either independently or in combination thereof.
- Study the behaviour of the structural member under the action of axial load, bending and twisting moment.
- Study the deformation behaviour of axially loaded columns having different end conditions and further, evaluate the strength of such columns.

The successful completion of the course will equip the students for undertaking the courses dealing with the analysis and design of determinate and indeterminate structures.

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 solved.

Oral Examination:

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

List of Practicals:

1. Tension test on mild steel bars (stress-strain behaviour ,Young's modulus determination)
2. Tests on Tor Steel (Tension, bend and re-bend)
3. Transverse Test on cast iron.
4. Shear Test on mild steel, cast iron, and brass.
5. Torsion Test on mild steel and cast iron bar.
6. Brinell Hardness test (any three metal specimen)
7. Rockwell Hardness test on mild steel.
8. Izod / Charpy impact test (any three metal specimen)

Term Work:

The term work shall comprise of the neatly written report based on the above mentioned experiments and assignments. 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 work by the student, appropriate completion of the assignments.

Recommended Books:

1. Strength of Materials: *S. Ramamrutham*, Dhanpatrai Publishers.
2. Strength of Materials: *R.K. Rajput*, S. Chand Publications.
3. Mechanics of Materials: Vol-I: *S.B. Junnarkar and H.J. Shah*, Charotar Publications.
4. Strength of Materials: *Subramanian*, Oxford University Press
5. Strength of Materials: *S.S. Rattan*, Tata Mc-Graw Hill, New Delhi
6. Strength of Materials (Mechanics of Materials): *R.S. Lehri and A.S. Lehri*, S.K.Kataria Publishers, New Delhi
7. Strength of Materials: *Dr. V.L.Shah*, Structures Publications, Pune

Reference Books:

8. Mechanics of Materials: *James, M. and Barry J.*; Cengage Learning.
9. Mechanics of Materials: *Andrew Pytel and Jaan Kiusalaas*, Cengage Learning.
10. Mechanics of Materials: *Timoshenko and Gere*, Tata McGraw Hill, New Delhi.
11. Mechanics of Materials: *James M. Gere*, Books/Cole.
12. Strength of Materials: *G.H. Ryder*, Mc-Millan.
13. Mechanics of Materials: *E.P. Popov*, Prentice Hall India (PHI) Pvt. Ltd.
14. Mechanics of Materials: *Pytel and Singer*, Mc-Graw Hill, New Delhi.
15. Strength of Materials: *William A. Nash and Nillanjan Mallick*, Mc-Graw Hill Book Co .(Schaum's Outline Series)
16. Mechanics of Materials: *Beer and Johnson*, Tata Mc-Graw Hill New Delhi.

Semester III

Subject Code	Subject Name	Credits
CE-C 304	Building Materials and Construction	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

Materials are essential elements, constituent parts (or) substances which are used to raise a building, but materials could not be turned into structures without a method of construction. This subject provides necessary knowledge about properties and uses of different types of building materials. This subject is intended for gaining useful knowledge with respect to facts, concepts, principles and procedures related to building construction system so that student can effectively plan and execute building construction work.

Objectives

- To study the manufacturing process, properties, and use of different types of building materials like cement, lime, mortar, concrete, stone, brick, timber, including materials such as paints and varnishes used for treatment of the surfaces so as to achieve good knowledge about the building materials.
- To enable the students to identify various components of building (foundation, masonry, roof and floor, staircase etc.), their functions and methods of construction so as to achieve good knowledge about building construction.

Detailed Syllabus			
Module	**Sub-Modules/ Contents**		**Periods**
I.	**Foundations** Different types of structures such as load bearing structures, framed structures and composite structures, Introduction to different types of foundations: Stepped foundations, column footing, combined footing, under-reamed pile foundations.		**7**
	Construction Materials: Classification and Properties		
	1.1	Classification of materials, building materials symbols and requirements of building materials and products: functional, aesthetical and economical.	
	1.2	Study of properties of materials-physical, mechanical, chemical, biological and other like durability, reliability, compatibility and economic characteristics.	
II.	**Raw Materials, Manufacturing Process and Properties of Basic Construction Materials.**		**6**
	2.1	Rocks (Stone) - quarrying, milling and surface finishing, preservative treatments.	
	2.2	Structural clay products- bricks, roofing tiles, ceramic tiles, raw materials and manufacturing process.	
	2.3	Concrete blocks, flooring tiles, paver blocks-raw materials and manufacturing process.	
	2.4	Binder material: lime, cement: physical properties and manufacturing process, plaster of Paris- properties and uses.	
	2.5	Mortar - ingredients, preparation and uses.	
III.	**Masonry Construction and Masonry Finishes**		**6**
	3.1	Classification and bonding of stone, brick and concrete blocks	
	3.2	Masonry finishes-pointing, plastering and painting	
	3.3	**Paints and Varnishes**	
		Types, constituents and uses.	
IV.	**4.1**	**Formwork**	**6**
		Materials used, design considerations, shuttering, centering and staging, scaffolding.	
	4.2	**Floor and Roofs**	
		Type of floors, floor finishes and suitability. Type of roofs, wooden and steel trusses and roof covering	

V.	**5.1**	**Glass**	**7**
		Types and uses. Introduction to glass fibre reinforced plastic.	
	5.2	**Timber**	
		Varieties, defects in timber, preservative treatments and wood composites.	
	5.3	**Metal and Alloys**	
		Ferrous and non ferrous metals and alloys, aluminum, tin, zinc, nickel - types and uses and anti-corrosive treatment.	
VI.	**Building Services, Air conditioning and Ventilation, Acoustics and Sound Insulation, Damp-proofing and Water proofing.**		**7**
	6.1	Air conditioning: systems of heating, air conditioning, ventilation, construction requirements.	
	6.2	Acoustics and sound insulation: Characteristics of sound, reflection and absorption coefficient, acoustical defects, design and material.	
	6.3	Damp-proofing and water proofing: materials and methods	

Contribution to Outcomes

On completion of the course, the students will be:

- Able to identify the various building materials with symbols.
- Able to identify the properties of building materials.
- Made acquainted with the manufacturing process of basic construction materials.
- Made acquainted with the masonry construction and finishes
- Aware of building services, acoustics, DPC, etc.

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 solved.

Oral Examination:

The oral examination shall be based on the entire syllabus and term work comprising of the report of the experiments/ practicals conducted by the students and a detail report of the industrial/ site visit.

List of Experiments/ Practicals: (Minimum **seven** to be performed)

1. Water absorption and compressive strength test of bricks.
2. Water absorption and transverse load test on tiles.
3. Moisture content and flexural strength test on timber.
4. Compression test on timber (Parallel/ perpendicular to the grains).
5. Physical properties of cement: Fineness, consistency, setting time, Soundness, Compressive strength.
6. Compression test on Paver blocks.
7. Water absorption, density and compression test on masonry blocks.
8. Abrasion test on tiles.

Site Visit/ Industrial Visit:

The students shall visit the brick, paver blocks, concrete block, cement, glass and plastic manufacturing industrial plants. They shall study various aspects of the plant along with various operations. The visit to any site where construction is going on may be arranged and the students may be made aware of the various construction activities. They shall prepare a report of the visit which shall include all above points. The same shall be evaluated by the concerned teacher.

Term Work:

The term work shall consist of:

- Report of minimum **07** experiments.
- Assignments, including at least **20** sketches on A2 size drawing sheets covering entire syllabus.
- Industrial visit report to at least **any one** of the above mentioned industrial plants.

Although minimum numbers of experiments and industrial visits are prescribed, the students shall be encouraged to perform more number of experiments and site/ industrial visits.

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 including industrial/ site visit report. 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. Building Construction: *S. P. Bindra and S. P. Arora*, Dhanpat Rai and Sons, Delhi.
2. Building Drawing: *M. G. Shah, C. M. Kale and S. Y. Palki*, Tata Mc-Graw Hill, Delhi.
3. Services in Building Complex: *V. K. Jain*, Khanna Publishers.
4. Materials of Construction: *D. N. Ghose*, Tata McGraw Hill, Delhi.
5. Architectural Materials science*: D. Anapetor*, Mir Publishers.
6. Introduction to Engineering Materials: *B. K. Agrawal*, Tata McGraw Hill New Delhi.
7. Engineering Materials: S.*R. Rangwala,* Charotar Publications.
8. Engineering Materials: *P. Surendra Singh*, Vani Education Books New Delhi.
9. Building Construction: *Rangwala*, Charotar Publications, Anand (Gujrat).
10. Building Materials (Products, Properties and Systems): *M.L.Gambhir and Neha Jamwal*, Mc-Graw Hill Publications.
11. Specifications for different materials, BIS Publications, New Delhi

Semester III

Subject Code	Subject Name	Credits
CE-C 305	Engineering Geology	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 study of Geology helps to understand about geological formations, classifications and morphology of rocks, physical properties of minerals and the importance of the study of Geology for civil engineers with regard to founding the structures like dams, bridges, buildings etc. It also gives the ideas about geological formations in causing earthquake and landslides.

Objectives

- Study of importance of geological studies in various civil engineering projects and Interior of the earth.
- Study of physical geology including geological action of river, wind, glacier, volcano earthquake and weathering.
- Study of minerals and rocks with classification, structure, texture and origin.
- Study of structural geology including geological structure like fold, fault, joint, etc.
- Study of geological history of peninsular India with economic minerals and building stones of India.
- Study of methods of surface and subsurface investigation and their importance.
- Study of types, lithology structural conditions, advantages, difficulties, significance of geological structures during the construction of dam and tunnel.

- Study of ground water zones, factors controlling water bearing capacity of rocks, geological work of ground water and springs
- Study of types, causes, preventive measures for landslides.
- Study of building stones with geological and engineering properties.

Detailed Syllabus

Module	Sub-Modules/Contents		Periods
I	**1. Introduction**		**01**
	1.1	Branches of geology useful to civil engineering, Importance of geological studies in various civil engineering Projects.	
	1.2	Internal structure of the Earth and use of seismic waves in understanding the interior of the earth	
	2. General and Physical Geology		**08**
	2.1	Agents modifying the earth's surface, study of weathering and its significance in engineering properties of rocks like strength, water tightness and durability etc.	
	2.2	Brief study of geological action of river, wind, glacier, ground water and the related land forms created by them.	
	2.3	Volcano- Central type and fissure type, products of volcano, volcanic land forms.	
	2.4	Earthquake - Earthquake waves, construction and working of seismograph, Earthquake zones of India, elastic rebound theory Preventive measures for structures constructed in Earthquake prone areas.	
II	**3. Mineralogy**		**01**
	Identification of minerals with the help of physical properties, rock forming minerals, megascopic identification of primary and secondary minerals, study of common ore minerals		
	4.Petrology Study of igneous, sedimentary and metamorphic rocks, distinguishing properties among these three rocks to identify them in fields.		**06**
	4.1	Igneous Petrology - Mode of formation, Texture and structure, Classifications, study of common occurring igneous rocks.	

	4.2	Sedimentary Petrology - Mode of formation , Textures, characteristics of shallow water deposits like lamination, bedding, current bedding etc., residual deposits, chemically formed and organically deposits, classification and study of commonly occurring sedimentary rocks.	
	4.3	Metamorphic Petrology - Mode of formation, agents and types of metamorphism, metamorphic minerals, rock cleavage, structures and textures of metamorphic rocks, classification and study of commonly occurring metamorphic rocks.	
III	**5. Structural Geology**		**03**
	Structural elements of rocks, dip, strike, outcrop patterns unconformities, outliers and inlier, study of joints. Faults and folds, importance of structural elements in engineering operations.		
	6. Stratigraphy and Indian Geology		**02**
	General principles of Stratiagraphy, geological time scale, Physiographic divisions of India and their characteristics. Stratiagraphy of Maharashtra		
IV	**7. Geological Investigation**		**04**
	7.1	Preliminary Geological Investigation and their importance to achieve safety and economy of the projects supporting dams and tunnel projects ,methods of surface and subsurface investigations, excavations-Trial pit, trenches etc.	
	7.2	Core Drilling - Geological logging, Inclined Drill holes. Electrical Resistivity method, Seismic method and their applications.	
	7.3	Use of Aerial photographs, Satellite imageries in civil engineering projects.	
	8. Geology of dam and reservoir site:		**04**
	8.1	Strengths, stability, water tightness over the foundation rocks and its physical characters against geological structures at dam sites, favorable and unfavorable conditions for locating dam sites.	
	8.2	Precautions over the unfavorable geological structures like faults , dykes , joints, unfavorable dips on dam sites and giving treatments, structural and erosional valleys.	
V	**9. Tunneling**		**03**
	Importance of geological considerations while choosing tunnel sites and alignments of the tunnel, safe and unsafe geological and structural conditions, Difficulties during tunneling and methods to overcome the difficulties.		
	10. Ground water		**03**

	10.1	Sources, zones, water table, unconfined and Perched water tables. Factors controlling water bearing capacity of rocks, Pervious and Impervious rocks, Cone of depression and its use in Civil engineering. Geological work of groundwater, Artesian well.	
	10.2	Springs seepage sites and geological structures. Different types of rocks as source of ground water	
VI	**11. Recharge of ground water**		**03**
	Methods of artificial recharge of ground water, geology of percolation tank.		
	12. Land slides		
	Types, causes and preventive measures for landslides, Landslides in Deccan region.		
	13. Building stones		**01**
	Requirements of good building stones and its geological factors, controlling properties, consideration of common rocks as building stones, study of different building stones from various formations of Indian Peninsula,		

Contribution to Outcomes

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

- Understand the interior structure of the earth and seismological evidences.
- Identify various landforms which are created by geological agents like wind, river, glaciers, volcanoes and earthquake.
- Recognize various types of minerals with physical properties, rocks with their textures, structures and origin. Also use of common building stones.
- Understand geological structure like folds, faults, joints, unconformity etc. knowledge of which is very essential in the design and construction of dams, tunnels etc.
- Understand surface and subsurface strata, the sources and zones of ground water.
- Apply the preventive measures for landslide and earthquake prone areas.
- Take a self decision to make his report over the site with the Geological ingredients and information, up to the need of project aim.

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 **fou**r questions need to be attempted.

Oral Examination:

Oral examination will be based on the entire syllabus and a neatly written report for the practicals along with a report of the site visit.

List of Practicals:

1. Study of physical properties of the minerals.
2. Identification of minerals- Quartz and its varieties, Orthoclase, Plagioclase, Muscovite, Biotite, Hornblende, Asbestos, Augite, Olivin, Tourmaline, Garnet, Actinolite, Calcite, Dolomite, Gypsum, Beryl, Bauxite, Graphite, Galena, Pyrite. Hematite, Magnetite, Chromite, Corundum, Talc, Fluorite, Kyanite.
3. Identification of rocks: *Igneous rocks*- Granite and its varieties, Syenite, Diorite, Gabbro, Pegmatite. Porphyry, Dolerite, Rhyolite, Pumice, Trachyte, Basalt and its varieties, Volcanic Breccia, Volcanic tuffs. *Sedimentwy Rocks*- Conglomerate, Breccia, Sandstone and its varieties, Shales,Limestones, Laterites. *Metamorphic Rocks*- Mica Schists, Hornblende Schists, Slate, Phyllite, Granite Gneiss , Augen gneiss, Marbles and Quartzite.
4. Study of Geological maps (At least 5).
5. Study of core samples, RQD, Core logging.
6. At least two engineering problems based on field data collected during site investigation.

Term Work:

The term work shall consist of the:

- Report of the practical conducted in terms of the study of the physical properties of the minerals, identification of minerals and rocks.
- Report of the Geological maps
- Report of the two problems based on field data.
- At least *eight* assignments covering entire syllabus

Site Visit:

There shall be a visit to get the geological information according to the various contents mentioned in the syllabus. The students shall prepare a detail report thereof along with the summarized findings. The report will form a part of the term work.

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 ensures the satisfactory performance of laboratory work.

Recommended Books:

1. Text book of Engineering Geology: *Dr. R. B. Gupte*, Pune Vidyarthi Griha Prakashan, Pune.
2. Text book of Engineering Geology: *P. K. Mukerjee*, Asia.
3. Text book of Engineering and General Geology: *Parbin Singh*, Carson Publication.
4. Text book of Engineering Geology: *N. Chenna, Kesavulu*, Mc-Millan.
5. Principles of Engineering Geology: *K. M. Banger*.

Reference Books:

1. Principles of Physical Geology: Arthur Homes, Thomas Nelson Publications, London.
2. Principles of Geomorphology: *William D. Thornbury*, John Wiley Publications, New York.
3. Geology for Civil Engineering: A. *C. McLean, C.D. Gribble, George Allen & Unwin* London.
4. Engineering Geology: A Prrthsarathy, V. Panchapakesan, R Nagarajan, Wiley India 2013.

Semester III

Subject Code	Subject Name	Credits
CE-C 306	Fluid Mechanics-I	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	-	-	125

Rationale

The concept of fluid mechanics in civil engineering is essential to understand the processes and science of fluids. The course deals with the basic concepts and principles in hydrostatics, hydro kinematics and hydrodynamics with their applications in fluid flow problems.

Objectives

Students are introduced to:

- Properties of fluid and basic concepts applicable to fluid mechanics.
- Pascal's law, hydrostatic law and determination of Hydrostatic pressure and centre of pressure.
- Principle of buoyancy and its application
- Liquids in relative equilibrium.
- The concept of ideal fluid and fluid mechanics.
- Various flow measuring devices and their applications in the field.

Detailed Syllabus

Module	Sub-Modules/Contents	Periods
I.	**1. Properties of fluids**	**03**
	Mass density, weight density, specific gravity, specific volume, viscosity,	

	compressibility and elasticity, surface tension, capillarity, vapour pressure, types of fluids, basic concepts applicable to fluid mechanics.		
	2. Fluid Statics		**09**
	2.1	Pascal's law, hydrostatic law, pressure variation in fluids at rest. Absolute, atmospheric, gauge pressure, measurement of pressures.	
	2.2	Hydrostatic force on surface, total pressure and centre of pressure, total pressure on horizontal plane surface, vertical plane surface, Inclined plane surface, centre of pressure for vertical plane surface and for inclined plane surface, practical applications of total pressure and centre of pressure on dams, gates, and tanks.	
	2.3	Buoyancy and flotation, Archimedes principle, Metacentre, metacentric height, Stability of floating and submerged bodies, determination of metacentric height, metacentric height for floating bodies containing liquid, Time period of Transverse oscillations of floating bodies.	
II	**3. Liquids in Relative equilibrium**		**03**
	Fluid mass subjected to uniform linear acceleration, liquid containers subjected to constant horizontal acceleration and vertical acceleration, fluid containers subjected to constant rotation with axis vertical and horizontal.		
	4. Fluid Kinematics		**05**
	Types of fluid flow, description of flow pattern, Lagrangian methods, Eulerian method, continuity equation, velocity and acceleration of fluid particles, velocity potential and stream function, streamline, streak line, path line, equipotential lines and flow net, uses of flow net, rotational and irrotational motions, circulation and vorticity.		
III.	**5. Fluid dynamics**		**08**
	Control volume and control surface, Forces acting on fluid in motion, Navier-Stokes Equation, Euler's Equation of motion , Integration of Euler's equations of motion, Bernoulli's Theorem and its derivation , Bernoulli's equation for compressible fluid and real fluid, applications of Bernoulli's Equation - Venturimeter, Orifice meter, nozzle meter, pitot tube		
IV.	**Orifices and Mouthpieces**		**05**
	6.1	Classification of orifices, flow through orifices, determination of hydraulic coefficients, flow through large rectangular orifice, flow through fully submerged and partially submerged orifice, time of emptying a tank through an orifice at its bottom	

	6.2	Classification of Mouthpieces, Flow through external cylindrical mouthpiece, convergent-divergent mouthpiece, Borda's mouthpieces.	
V.	**7. Notches and Weirs**		**04**
	Classification of notches and weirs, discharge over a rectangular, triangular, trapezoidal notch/weir, velocity of approach, stepped notch, Cipolleti weir, broad crested weir, ogee weir, discharge over a submerged weir, ventilation of weirs.		
VI.	**8. Introduction to Ideal fluid flow**		**02**
	8.1	Uniform flow, source and Sink, free vortex flow, superimposed flow, doublet,	
	8.2	Flow past a half body, flow past a Rankine oval body and flow past a cylinder.	

Contribution to Outcomes

On completion of this course the student will be able to:

- Understand basic properties of fluids and basic definitions.
- Study of pressure measuring devices.
- Study of pressure on the surface in the contact of fluids and its applications.
- Understand the concepts of buoyancy and flotation and its applications.
- Understand the fundamentals of kinematics.
- Apply Bernoulli's principle to fluid flow problems.
- Measure velocity and rate of flow using various devices.
- Concept of ideal fluid flow.

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.

List of Experiments (Any six):

1. Determination of metacentric height.

2. Verification of Bernoulli's theorem.
3. Determination of coefficient of discharge through Venturimeter.
4. Determination of coefficient of discharge through Orificemeter.
5. Determination of coefficient of discharge through Nozzlemeter.
6. Determination of coefficient of discharge through Notches (Rectangular and Triangular notch).
7. Determination of coefficient of discharge over weirs (Broad Crested weir and Ogee weir).
8. Determination of hydraulic coefficients of orifice.
9. Determination of coefficient of discharge through mouthpiece.

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 Hydraulics: *Dr. S.K. Ukarande,* Ane's Books Pvt. Ltd. (Revised Edition 2012), ISBN 97893 8116 2538
5. Fluid Mechanics and fluid pressure engineering: *Dr. D.S. Kumar, F.K. Kataria* and *sons*
6. Fluid Mechanics: *R.K. Bansal* Laxmi Publications (P) Ltd.

Reference Books:

1. Fluid Mechanics: *Frank M. White*, Tata Mc-Graw Hill International Edition.
2. Fluid Mechanics: *Streeter White Bedford*, Tata Mc-Graw International Edition.

3. Fluid Mechanics with Engineering Applications: *R.L. Daugherty, J.B. Franzini, E.J. Finnemore*, Tata Mc-Graw Hill, New Delhi.
4. Hydraulics: *James F. Cruise, Vijay P.Singh and Mohsen M. Sherif,* CENGAGE Learning India (Pvt.) Ltd.
5. Introduction to Fluid Mechanics: *Edward J. Shaughnessy,Jr, Ira M. Katz, James P. Schaffer*. Oxford Higher Education.

Semester III

Subject Code	Subject Name	Credits
CE- C 307	Database and Information Retrieval System	2

Teaching Scheme

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

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						
-	-	-	-	-	25	25#		

Rationale

The students of Civil Engineering are often required to deal with the huge amount of data. The students are expected to be aware of the management of the data and its retrieval whenever need arises. This course concerns with the management of information and how to model it in the structured manner. The use of database management, as an application tool to manipulate the information which has been modelled earlier, will provide the students a further step in order to apply an application of information technology in solving the problems of diverse spectrums of the field of Civil Engineering.

Objectives

The course aims at:

- Learning and practicing the data modeling using the entity-relationship and developing database designs.
- Understanding the use of Structured Query Language (SQL) and learn SQL syntax.
- Applying Graphical User Interface techniques for retrieve the information from database
- Understanding the needs of database processing and learn techniques for controlling the consequences of concurrent data access.

Detailed Syllabus

Module	Sub- Modules/ Contents
I.	**Introduction Database Concepts**
	What is a database? , Characteristics of databases, Example of database, File system V/s Database system, What is DBMS?, Users of Database system, Advantage of using an enterprise database, Concerns when using an enterprise database, Data Independence, DBMS system architecture, Database Administrator,
II.	**Entity–Relationship Data Model**
	Introduction, Benefits of Data Modeling, Types of Models, Phases of Database Modeling, The Entity-Relationship (ER) Model, Generalization, Specialization and Aggregation, Extended Entity-Relationship (EER) Model.
III.	**Relational Model and Algebra**
	Introduction , Mapping the ER and EER Model to the Relational Model , Data Manipulation , Data Integrity ,Advantages of the Relational Model, Relational Algebra , Relational Algebra Queries, Relational Calculus.
IV.	**Structured Query Language (SQL)**
	Overview of SQL, Data Definition Commands, Set operations, aggregate function, null values, Data Manipulation commands, Data Control commands, Views-Using Virtual Tables in SQL, Nested and complex queries.
V.	**Introduction to Transactions Management and Concurrency**
	Transaction concept, Transaction states, ACID properties, Implementation of atomicity and durability, Concurrent Executions, Serializability, Recoverability, Concurrency Control: Lock-based , Timestamp-based , Validation-based protocols, Deadlock handling, Recovery System: Failure Classification, Storage structure, Recovery and atomicity, Log based recovery, Shadow paging.
VI.	**Graphical User Interface**
	Murphy ’s Law of G U I Design, Features of G U I, Icons and graphics, Identifying visual cues, clear communication, color selection, GUI standard, planning GUI Design Work. **Visual programming :** ***Sharing Data and Code*:** Working with Projects, Introduction to Basic language, Using inbuilt controls and ActiveX controls, creating and using classes, Introduction to Collections, Using and creating ActiveX Components, dynamic data exchange, object linking and embedding.

	Creating visual software entities: Working with text, graphics, working with files, file management, serial communication, and multimedia control interfaces.

*Out of 4 (Four) clock hours designated for this course under the head of Practicals, 2 (Two) clock hours out of these 4 (Four), may be utilized as the Theory and accordingly, the provision may be made in the time-table of the respective Colleges/ Institutes.

# Indicates the Practical Examination in conjunction with the Oral.

Contribution to Outcomes

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

- Describe data models and schemas in DBMS
- Understand the features of database management systems and relational database.
- Use SQL- the standard language of relational databases.
- Understand the functional dependencies and design of the database.
- Understand the graphical user Interface design.

Term Work:

The each student shall be assigned minimum two *case studies* to perform on the following experiments:

(1) Problem Definition and draw ER /EER diagram
(2) Design Relational Model
(3) Perform DDL operation
(4) Perform DML and DCL operations
(5) Design Forms using Visual programming
(6) Retrieve the information through GUI.

Guidelines for Conducting Practical Examination:

(1) Practical examination duration shall be of 2 (Two) hours and questions shall be based on the list of afore-mentioned experiments mentioned under the head of Term Work.
(2) Evaluation of practical examination shall be done by external examiner based on the printout of students' work
(3) Practical examination: 40 marks, oral examination based on practical examination: 10 marks
(4) Students' work along with evaluation report to be preserved till the next examination

Recommended Books:

1. Database System Concepts: *Korth, Slberchatz, Sudarshan*, 6th Edition, McGraw – Hill.

2. Database Management Systems: *G. K. Gupta*, McGraw – Hill.
3. GUI Design for dummies: IDG books.
4. Visual Basic 2005, How to program (3RD Edition): *Deitel & Deitel*, Pearson Education.
5. SQL and PL/SQL for Oracle 10g: *Dr. P.S. Deshpande*, Dreamtech Press.
6. Introduction to Database Management: *Mark L. Gillenson, Paulraj Ponniah*, Weley
7. Oracle for Professional: *Sharaman Shah*, SPD.
8. Database Management Systems: *Raghu Ramkrishnan and Johannes Gehrke*, TMH

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.