AC. 11/5/2017

Item No. 4.177

UNIVERSITY OF MUMBAI

Bachelor of Engineering

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

Revised course (REV – 2016)

With Effect From Academic Year 2017 – 18

Under the

FACULTY OF TECHNOLOGY

(As per Semester Choice Based Credit and Grading System)

University of Mumbai

Scheme of Instructions and Examination

Second Year Engineering (Civil Engineering)

(With effect from 2017 – 2018)

(Semester–III)

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CE-C301	Applied Mathematics–III*	4	-	1	4	-	1	5
CE-C302	Surveying – I	4	2	-	4	1	-	5
CE-C303	Strength of Materials	4	2	-	4	1	-	5
CE-C304	Engineering Geology	3	2	-	3	1	-	4
CE-C305	Fluid Mechanics – I	3	2	-	3	1	-	4
Total		**17**	**8**	**1**	**17**	**4**	**1**	**23**

Course Code	Course Name	Examination Scheme							
		Theory					TW	Oral & Practical	Total
		Internal Assessment			End Sem Exam	Exam Duration			
		Test1	Test2	Avg.					
CE-C301	Applied Mathematics – III	20	20	20	80	3	25	-	125
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	Engineering Geology	20	20	20	80	3	25	25	150
CE-C305	Fluid Mechanics – I	20	20	20	80	3	25	25	150
Total		--	--	**100**	**400**	-	**125**	**100**	**725**

*Common with Mechanical/ Automobile/ Mechatronics

Semester III		
Subject Code	**Subject Name**	**Credits**
CE-C 301	Applied Mathematics – III*	05

Teaching Scheme						
Contact Hours			**Credits Assigned**			
Theory	**Practical**	**Tutorial**	**Theory**	**Practical**	**Tutorials**	**Total**
04	-	01	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	-	-	125

Rationale

The course is aimed to develop the basic Mathematical skills of engineering students that are imperative for effective understanding of engineering subjects. The topics introduced will serve as basic tools for specialized studies in many fields of engineering and technology.

Objectives

- To provide sound foundation in the mathematical fundamentals necessary to formulate, solve and analyse engineering problems.
- To study the basic principles of Laplace Transform, Fourier series, Complex variables

Detailed Syllabus			
Module	**Sub-Modules/ Contents**		**Periods**
I.	**1. Laplace Transform**		**12**
	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. (without proof)	

		$L\{t^n f(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\left\{\frac{d^n f(t)}{dt^n}\right\}$ Heaviside Unit step function, Direct Delta function, Periodic functions and their Laplace Transform.	
	1.3	**Inverse Laplace Transform:** Linearity property, use of theorems to find inverse Laplace Transform, Partial fractions method and convolution theorem.	
	1.4	Applications to solve initial and boundary value problems involving ordinary Differential equations with one dependent variable.	
II.	**2. Complex variables**		**08**
	2.1	Functions of complex variable, Analytic function, necessary and sufficient conditions for f (z) to be analytic (without proof), Cauchy-Riemann equations in polar coordinates.	
	2.2	Milne-Thomson method to determine analytic function f (z) when it's real or imaginary or its combination is given. Harmonic function, orthogonal trajectories.	
	2.3	Mapping: Conformal mapping, standard transformations such as translation, rotation and magnification, inversion and reflection, linear transformation, bilinear transformation, cross ratio, fixed points.	
III.	**3. Complex Integration**		**9**
	3.1	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.	
	3.2	Singularities, Classification of singularities	
	3.3	Taylor's and Laurent's series development (without proof)	
	3.4	Residue at isolated singularity and its evaluation.	
	3.5	Residue theorem, application to evaluate real integral of type $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta, \quad \& \quad \int_{-\infty}^{\infty} f(x)\, dx$	
IV.	**4. Fourier Series**		**09**
	4.1	Orthogonal and orthonormal functions, Construction of orthonormal set.	
	4.2	Dirichlet conditions. Fourier series of periodic function with period 2 &2l .Fourier series of even and odd functions, Half range sine and cosine series	
	4.3	Parseval's identities (without proof)	
	4.4	Complex form of Fourier series.	

V.	**5. Partial Differential Equations**		**08**
	5.1	Classification of partial differential equations of second order, Heat equation, Wave equation, Laplace equation,	
	5.2	Method of Separation of variables, Solution of one dimensional heat conduction equation, steady state configuration for heat flow, solution of one dimensional wave equation, transverse vibrations of an elastic string, Laplace equation in rectangular region, Use of Fourier series and applications of Laplace transform in solving these equations.	
	5.3	Numerical Solution of Partial differential equations using Bender-Schmidt Explicit Method and simplified Crank- Nicolson implicit method.	
VI.	**6.1 Correlation and Regression.**		**06**
	6.1.1	Correlation, Co-variance, Karl Pearson Coefficient of Correlation and Spearman's Rank Correlation Coefficient (non-repeated and repeated ranks)	
	6.1.2	Regression Coefficients and lines of regression	
	6.2 Curve fitting		
	6.2.1	Curve fitting by the method of least squares- fitting of the curves of the form, $y = ax + b$, $y = ax^2 + bx + c$ and $y = ae^{bx}$.	
		Total	**52**

Contribution to Outcomes

Learner will be able to…

- Solve the Ordinary and Partial Differential Equations using Laplace Transformation.
- Solve Ordinary and Partial Differential Equations using Fourier series.
- Solve initial and boundary value problems involving ordinary differential equations
- Fit the curve using concept of correlation and regression.
- 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 – 5marks covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus and may before 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. Remaining questions will be mixed in nature (e.g. Suppose Q.2 has part (a) from module II then part (b) will be from any module other than module II).
5. The students will have to attempt any three questions out of remaining five questions.
6. Total four questions need to be attempted.

Internal Assessment:

There will be two class tests (to be referred to as an 'Internal Assessment) to be conducted in the semester. The first internal assessment (IA) will be conducted in the mid of the semester based on the 40% of the syllabus. It will be of 20 marks. Similarly, the second internal assessment (IA) will be conducted at the end of the semester and it will be based on next 40% of the syllabus. It will be of 20 marks. Lastly, the average of the marks scored by the students in both the Internal Assessment will be considered. Duration of both the IA examination will be of one hour duration, respectively.

Term Work Examination:

The marks of term-work shall be judiciously awarded depending upon the quality of the term work including that of the report on experiments assignments. The final certification acceptance of term-work warrants the satisfactory the appropriate completion of the assignments the minimum passing marks to be obtained by the students. Broadly, the split of the marks for term work shall be as given below. However, there can be further bifurcation in the marks under any of the heads to account for any sub-head therein.

Assignments (02) on entire syllabus	:	05 marks
Class Tutorials on entire syllabus (08)	:	15 marks
Attendance (Theory and Tutorial)	:	05 marks
Total	**:**	**25 marks**

Further, while giving weightage of marks on the attendance, following guidelines shall be resorted to. 75% – 80%: 03 Marks; 81% – 90%: 04 Marks 91% onwards: 05 Marks

General Instructions:

1. Batch wise tutorials are to be conducted. The number of students per batch should be as per University rules for practical.
2. Students must be encouraged to write assignments in tutorial class only. Each student has to complete at least 8 class tutorials on entire syllabus.

Recommended Books:

1. Higher Engineering Mathematics, *Dr B. S. Grewal*, Khanna Publication.
2. Advanced Engineering Mathematics, *E Kreyszing*, Wiley Eastern Limited.
3. Higher Engineering Mathematics, *B.V. Ramana*, McGraw Hill Education, New Delhi.
4. Complex Variables: *Churchill*, Mc-Graw Hill.
5. Integral Transforms and their Engineering Applications, *Dr B. B. Singh*, Synergy Knowledgeware, Mumbai.
6. Numerical Methods, *Kandasamy*, S. Chand & CO.

Semester III		
Subject Code	**Subject Name**	**Credits**
CE-C 302	Surveying – I	5

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

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 instruments 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

- To understand appropriate methods of surveying based on accuracy and precision required availability of resources, economics and duration of project.
- To study techniques for measurement of distance, setting offsets, calculate area and volume using surveying instruments
- To study the functions of various instruments, their least counts, possible errors, advantages and limitations.
- To study various techniques for solving Surveying related problems.
- To study the superiority and leverage of using modern methods in surveying over conventional ones.

Detailed Syllabus			
Module	**Sub-Modules/ Contents**		**Periods**
I.	**1. Introduction**		**08**
	1.1	Definition, principles, objectives, classification, technical terms, uses and necessity of surveying. Units of measurement, surveying measurement and errors, type of errors and their corrections (including numericals), corrections for wrong scales, accuracy and precision, stages of survey operations	
	1.2	Chaining, Ranging and offsetting: Definitions, Principles, Types, Instruments required, methods, obstacles (including numericals), sources of errors, conventional signs and symbols.	
	1.3	Electronic Distance Measurement: Working Principles, types, applications in surveying	
II.	**2. Measurement of Directions and Angles**		**10**
	2.1	Basic definitions, meridians, bearings, magnetic and true bearings, compasses, prismatic and surveyor's, temporary adjustments, declination, dip, local attraction	
	2.2	Types of traverse, procedures, control establishments, Conversion of WCB into RB and vice-versa, Traverse Survey and Computations of interior angles of a closed Traverse. Adjustment of closing error, correction for local attraction.	
III.	**3. Levelling and its application**		**12**
	3.1	Introduction to levelling, basic terms and definitions, types of instruments, construction and use of dumpy level, auto level, digital level and laser level in construction industry, principle axes of dumpy level, temporary and permanent adjustments	
	3.2	Booking and reduction of levels, plane of collimation (HI) and rise-fall methods, computation of missing data, distance to the visible horizon, corrections due to curvature and refraction, reciprocal levelling, Numerical problems	
	3.3	Differential levelling, profile levelling, fly levelling, check levelling, precise levelling, sources of errors, difficulties in levelling work, corrections and precautions in levelling work.	

IV.	**4. Plane Tabling, Contouring, Area and Volume**		**08**
	4.1	**Plane Table Surveying:** Definition, principles, accessories required for plane table surveying, merits and demerits, temporary adjustments, Different methods of plane table surveying, Errors in plane table surveying, Use of telescopic alidade.	
	4.2	**Contouring**: definitions, contour interval, equivalent, uses and characteristics of contour lines, direct and indirect methods of contouring. Grade contour: definition and use.	
	4.3	**Area**: Area of an irregular figure by trapezoidal rule, average ordinate rule, Simpson's 1/3 rule, various coordinate methods. Planimeter: types including digital planimeter, area of zero circle, uses of planimeter.	
	4.4	**Volume**: Computation of volume by trapezoidal and prismoidal formula, volume from spot levels, volume from contour plans.	
V.	**5. Theodolite Traversing**		**10**
	5.1	Various parts and axis of transit, technical terms, temporary and permanent adjustments of a transit, horizontal and vertical angles, methods of repetition and reiteration.	
	5.2	Different methods of running a theodolite traverse, Latitudes and departures, rectangular coordinates, traverse adjustments by Bowditch's, transit and modified transit rules, Gales Traverse Table, Numerical Problems.	
	5.3	Use of theodolite for various works such as prolongation of a straight line, setting out an angle, bearing measurements. Omitted measurements, Problems in using theodolite traversing, errors in theodolite traversing; Trigonometrical Levelling: Problems on one plane and two plane methods,	
VI.	**6. Tacheometric surveying**		**06**
	6.1	Principle, purpose, uses, advantages and suitability of tacheometry, different methods of tacheometry, stadia formula, Stadia diagram and tables. Sub-tense bar method.	
	6.2	Application in plane table and curve setting.	
	6.3	Radial Contouring.	
		Total	**52**

Contribution to Outcomes

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

- Apply principles of surveying and leveling for civil engineering works
- Measure vertical and horizontal plane, linear and angular dimensions to arrive at solutions to basic surveying problems.
- Perform various practical and hence projects using different surveying instruments.
- Apply geometric principles for computing data and drawing plans and sections
- Analyze the obtained spatial data and compute areas and volumes and represent 3D data on plane surfaces (2D) as contours

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 4–5marks covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus and may be. 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. Remaining questions will be mixed in nature (e.g. Suppose Q.2 has part (a) from module II then part (b) will be from any module other than module II).
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:

The oral examination will be conducted in conjunction with the practical/s and will be based on the entire syllabus and the term work. The weightage of the practical examination will be of 10 marks and that of oral, 15 marks.

List of Practical:

1. Computing area of polygon by chaining, ranging and offsetting and verify distances by EDM
2. Measuring bearing of closed traverse using Prismatic/Surveyor’s compass and computing included angle.
3. Simple and differential levelling using dumpy level
4. Transferring R.L from benchmark to new point by auto level/digital level with at least three change points and performing check levelling
5. Measurement of horizontal angle by Repetition and Reiteration Method using Vernier Transit theodolite.
6. To find the constants of a tachometer and to verify filed distances.

7. To find R.L and distances by tachometric surveying.
8. To find height of inaccessible tower using one plane and two plane methods using Vernier Transit theodolite.
9. Plane table surveying by various methods with at least four stations.
10. Determination of areas of irregular figures by conventional/digital planimeter

Internal Assessment:

There will be two class tests (to be referred to as an 'Internal Assessment) to be conducted in the semester. The first internal assessment (IA) will be conducted in the mid of the semester based on the 40% of the syllabus. It will be of 20 marks. Similarly, the second internal assessment (IA) will be conducted at the end of the semester and it will be based on next 40% of the syllabus. It will be of 20 marks. Lastly, the average of the marks scored by the students in both the Internal Assessment will be considered. Duration of both the IA examination will be of one hour duration, respectively.

Term work:

It shall consist of the following:

- Field book based on afore-mentioned practicals conducted on and off the field.
- The account of practical performed with aim, apparatus, observations, calculations, results and inferences.
- 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. Broadly, the split of the marks for term work shall be as given below. However, there can be further bifurcation in the marks under any of the heads to account for any sub-head therein.

Assignments on entire syllabus	:	10 marks
Practical	:	10 marks
Attendance (Theory and Practical)	:	05 marks
Total	**:**	**25 marks**

Further, while giving weightage of marks on the attendance, following guidelines shall be resorted to. 75%– 80%: 03 Marks; 81%– 90%: 04 Marks 91% onwards: 05 Marks

Recommended Books:

1. Surveying and Leveling: Vol-I and II: *Kanetkar and Kulkarni*, Pune VidyarthiGriha, 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
8. Textbook of Surveying, By *C Venkatramaiah*, University Press, Hyderabad, Latest Edition

Web Materials:

1. http://nptel.ac.in/courses/105107122/

Semester III		
Subject Code	**Subject Name**	**Credits**
CE-C 303	Strength of Materials	5

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 analyse 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 torsion, 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 and struts using different theories available for the analysis with various end conditions.

Detailed Syllabus			
Module	**Sub-Modules/ Contents**		**Periods**
I.	**1. Simple Stresses and Strains**		**08**
	1.1	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.	
	1.2	Relationship between E, G and K, bars of varying sections, deformation due to self- weight, composite sections, temperature stress.	
II.	**2. Shear Force and Bending Moment in Beams**		**06**
	2.1	Axial force, shear force and bending moment diagrams for statically determinate beams including beams with internal hinges for different types of loading.	
	2.2	Relationship between rate of loading, shear force and bending moment.	
III.	**3.1 Theory of Simple Bending**		**07**
	3.1.1	Moment of inertia, transfer theorem, polar moment of inertia	
	3.1.2	Flexure formula for straight beam, simple problems involving application of flexure formula, section modulus, moment of resistance, flitched beams.	
	3.2 Strain Energy		**03**
	Strain energy due to axial force, stresses in axial member and simple beams under impact loading.		
IV.	**4.1 Shear Stresses in Beams**		**06**
	Distribution of shear stress across plane sections commonly used for structural purposes.		
	4.2 Theory of Simple Torsion		**06**
	4.2.1	Torsion in circular shafts-solid and hallow, stresses in shaft when transmitting power	
	4.2.2	Concept of equivalent torsional and bending moment	
V.	**5.1 Direct and Bending Stresses**		**05**
	Application to member's subjected to eccentric loads, core of section, problems on chimneys, retaining walls, dams, etc. involving lateral loads.		
	5.2 Columns and Struts		**04**
	Members subjected to axial loading, concept of buckling, Effective length, Euler's formula for columns and struts with different support conditions, Limitation of Euler's formula, Rankine's formula, Problems based on Euler's and Rankine's formulae.		

VI.	**6.1 Principal Planes and Stresses**	**04**
	General equation for transformation of stress, principal planes and principal stresses, maximum shear stress, stress determination using Mohr's circle.	
	6.2 Thin Cylindrical and Spherical Shells	**03**
	Thin Cylindrical and spherical shells under internal pressure.	
	Total	**52**

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 behavior under the effect of flexure (bending), shear and torsion either independently or in combination thereof.
- Study the behavior of the structural member under the action of axial load, bending and twisting moment.
- Study the deformation behavior 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 and may be. 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. There can be an internal choice in various questions/ sub-questions in order to accommodate the questions on all the topics/ sub-topics.
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:

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 behavior, 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)

Internal Assessment:

There will be two class tests (to be referred to as an 'Internal Assessment) to be conducted in the semester. The first internal assessment (IA) will be conducted in the mid of the semester based on the 40% of the syllabus. It will be of 20 marks. Similarly, the second internal assessment (IA) will be conducted at the end of the semester and it will be based on next 40% of the syllabus. It will be of 20 marks. Lastly, the average of the marks scored by the students in both the Internal Assessment will be considered. Duration of both the IA examination will be of one hour duration, respectively.

Term Work:

The term-work shall comprise of the neatly written report of the 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 modules/ sub-modules contents thereof further.

Distribution of Term-work Marks:

The marks of term-work shall be judiciously awarded depending upon the quality of the term work including that of the report on experiments assignments. The final certification acceptance of term-work warrants the satisfactory the appropriate completion of the assignments the minimum passing marks to be obtained by the students. Broadly, the split of the marks for term work shall be as given below. However, there can be further bifurcation in the marks under any of the heads to account for any sub-head therein.

Report of the Experiments	:	10 Marks
Assignments	:	10 Marks
Attendance	:	05 Marks
Total	**:**	**25 Marks**

Further, while giving weightage of marks on the attendance, following guidelines shall be resorted to.

75% – 80%: 03 Marks; 81% – 90%: 04 Marks; 91% onwards: 05 Marks

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 NillanjanMallick*, Mc-Graw Hill Book Co. (Schaum's Outline Series)

Semester III		
Subject Code	**Subject Name**	**Credits**
CE-C 304	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

Geology is the study of earth, the minerals and rocks of which it is made. The study of the structures presents in the rocks and the effects of the natural forces acting upon them is essential to understand by civil engineers because all work performed by them involves earth and its features. The study helps to understand the causes and prevention of many geological activities like earthquakes, landslides and volcano. For a civil engineering project like dams, bridges, buildings etc. to be successful the engineers must understand the foundation rock and their structures, it also helps them to examine rocks for important metals, oil, natural gas and ground water.

Objective

- To acquire basic knowledge of Geology and to understand its significance in various civil engineering projects.
- To study of 'Theory of Plate Tectonics' which helps to explain much of the global-scale geology including the formation of mountains, oceans, different landforms and the occurrence and distribution of earthquakes, volcanoes, landslides etc.
- To study minerals and rocks in detail in order to understand their origin, texture, structure and classification which is helpful to comment on suitability of rock type for any civil engineering project
- To study structural geology in order to understand deformational structures like fold, fault, joint, etc. and the forces responsible for their formation.
- To study methods of surface and subsurface investigation, advantages and disadvantages caused due to geological conditions during the construction of dam and tunnel.
- To study ground water zones, factors controlling water bearing capacity of rocks, geological work of ground water and techniques of recharge of groundwater.

Detailed Syllabus			
Module	**Sub-Modules/Contents**		**Periods**
I.	**Introduction**		**6**
	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, Theory of Plate Tectonics.	
	1.3	Agents modifying the earth's surface, study of weathering and its significance in engineering properties of rocks like strength, water tightness and durability etc.	
	1.4	Brief study of geological action of river, wind, glacier, ground water and the related land forms created by them.	
	1.5	Building stones- 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.	
II.	**Mineralogy and Petrology**		**7**
	2.1	Identification of minerals with the help of physical properties, rock forming minerals, megascopic identification of primary and secondary minerals, study of common ore minerals.	
	2.2	Igneous Petrology - Mode of formation, Texture and structure, Classifications, study of commonly occurring igneous rocks and their engineering application.	
	2.3	Sedimentary Petrology - Mode of formation, Textures, characteristics of shallow water deposits like lamination, bedding, current bedding etc., residual deposits, chemically and organically formed deposits, classification, study of commonly occurring sedimentary rocks and their engineering application.	
	2.4	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 and their engineering application.	
III.	**Structural Geology, Stratigraphy and Indian Geology**		**7**
	3.1	Structural elements of rocks, dip, strike, outcrop patterns, outliers and inliers, study of joints, unconformities and their engineering consideration. Faults and folds, their classification and importance in engineering operations.	

	3.2	Determination of thickness of the strata with the help of given data.	
	3.3	General principles of Stratigraphy, geological time scale, Physiographic divisions of India and their characteristics. Stratigraphy of Deccan Volcanic Province	
IV.	**Geological Investigation, study of dam and reservoir site:**		**7**
	4.1	Preliminary Geological Investigation and their importance to achieve safety and economy of the projects like dams and tunnels, methods of surface and subsurface investigations, Excavations-Trial pit, trenches etc.	
	4.2	Core Drilling - Geological logging, Inclined Drill holes. Electrical Resistivity method, Seismic method and their applications	
	4.3	Strengths, stability, water tightness of the foundation rocks and its physical characters against geological structures at dam sites, favourable and unfavourable geological conditions for locating dam sites.	
	4.4	Precautions over the unfavourable geological structures like faults,dykes, joints, unfavourable dips on dam sites and giving treatments, structural and erosional valleys.	
V.	**Tunnel Investigation and Ground Water Control**		**7**
	5.1	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. Methods of tunneling in soft soil	
	5.2	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. Artesian well (flowing and non-flowing)	
	5.3	Springs seepage sites and geological structures. Different types of rocks as source of ground water	
	5.4	Methods of artificial recharge of ground water, geology of percolation tank.	
VI.	**Geological Disasters and Control Measures**		**5**
	6.1	**Landslides –** Types, causes and preventive measures for landslides, Landslides in Deccan region	
	6.2	**Volcano-** Central type and fissure type, products of volcano and volcanic land forms.	
	6.3	**Earthquake-** Earthquake waves, construction and working of seismograph, Earthquake zones of India, elastic rebound theory Preventive measures for structures constructed in Earthquake prone areas.	
		Total	**39**

Contribution to Outcomes

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

- Understand the significance of geological studies for safe, stable and economic design of any civil engineering structure.
- Demonstrate the knowledge of geology to explain major geological processes such as formation of mountain, ocean and the occurrence and distribution of earthquakes and volcanoes.
- Explain various geological structures like folds, faults, joints, unconformity, their origin and distribution which are very essential in the design and construction of dams, tunnels and any other major civil engineering project.
- Understand methods of surface and subsurface investigation, advantages and disadvantages caused due to geological conditions during the construction of dam and tunnel.
- Understand the causes and prevention of natural hazard like earthquake, landslide, volcano etc. will help student to meet the specific needs with suitable considerations for public health and safety.
- Prepare effective reports mentioning advantages and disadvantages caused due to geological condition and can evaluate any site for civil engineering project.

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 4–5marks covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus and may be. 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. Remaining questions will be mixed in nature (e.g. Suppose Q.2 has part (a) from module II then part (b) will be from any module other than module II).
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:

Oral examination will be based on the entire syllabus and a neatly written report for the practical 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, Olivine, 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. ***Sedimentary 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.

Internal Assessment:

There will be two class tests (to be referred to as an 'Internal Assessment) to be conducted in the semester. The first internal assessment (IA) will be conducted in the mid of the semester based on the 40% of the syllabus. It will be of 20 marks. Similarly, the second internal assessment (IA) will be conducted at the end of the semester and it will be based on next 40% of the syllabus. It will be of 20 marks. Lastly, the average of the marks scored by the students in both the Internal Assessment will be considered. Duration of both the IA examination will be of one hour duration, respectively.

Term Work:

The term work shall consist of the:

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

Site Visit:

Preferably, 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 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. Broadly, the split of the marks for term work shall be as given below. However, there can be further bifurcation in the marks under any of the heads to account for any sub-head therein. In case, if the site visit is not conducted, the marks kept under the head of Site Visit may be considered under the head of Assignments.

Report of the Practicals	:	10 marks
Assignments	:	07 marks
Site Visit Report	:	03 marks
Attendance	:	05 marks
Total	**:**	**25 marks**

Further, while giving weightage of marks on the attendance, following guidelines shall be resorted to. 75% – 80%: 03 Marks; 81% – 90%: 04 Marks; 91% onwards: 05 Marks

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. Earth Revealed, Physical Geology: David McGeeary and Charles C. Plummer
1. Principles of Geomorphology: *William D. Thornbury*, John Wiley Publications, New York.
2. Geology for Civil Engineering: A. *C. McLean, C.D. Gribble, George Allen &Unwin*London.
3. Engineering Geology: A Parthsarathy, V. Panchapakesan, R Nagarajan, Wiley India 2013.

Semester III		
Subject Code	**Subject Name**	**Credits**
CE-C 305	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	--	25	150

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.

Course Objectives

Students are introduced to:

- Properties of fluids and basic concepts applicable to fluid mechanics and its relevance in civil engineering.
- Fundamentals of hydrostatics viz. Pascal's law, hydrostatic law and determination of hydrostatic pressure and centre of pressure of surfaces.
- Principle of buoyancy and its application
- The concept of fluid kinematics and ideal fluid flow.
- Concepts of control volume, control surface and dynamics of fluid flow.
- Various flow measuring devices and their applications

Detailed Syllabus			
Module	**Sub-Module / Contents**		**Periods**
I.	**1. Properties of Fluids**		**05**
	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		
II.	**2. Fluid Statics**		**08**
	2.1	**Pressure measurement:** Pascal's law, hydrostatic law, pressure variation in fluids at rest. Absolute, atmospheric, gauge pressure, measurement of pressure using manometers	
	2.2	**Hydrostatic force on surfaces:** 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, Meta-centre, 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.	
III.	**3. Liquids in Relative equilibrium and Fluid Kinematics**		**08**
	3.1	**Liquids in Relative equilibrium** 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.	
	3.2	**Fluid Kinematics:** 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	
IV.	**4. Introduction to Ideal flow.**		**04**
	Introduction to ideal fluid flow, uniform flow, source and Sink, free vortex flow, superimposed flow, doublet, Flow past a half body, flow past a Rankine oval body and flow past a cylinder		

V	**5. Fluid dynamics**		**06**
	Control volume and control surface, Forces acting on fluid in motion, NavierStokes 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, practical applications of Bernoulli's Equation - Venturimeter, Orifice meter, nozzle meter, pitot tube, rotameter.		
VI	**6. Flow measurement**		**08**
	6.1	**Orifices and Mouthpieces:** 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. Classification of Mouthpieces, Flow through external cylindrical mouthpiece, convergent-divergent mouthpiece, Borda's mouthpieces.	
	6.2	**Notches and Weirs:** 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.	
		Total	**39**

Contribution to Outcomes

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

- Define various properties of fluids, state and explain different types of laws and principles of fluid mechanics.
- Interpret different forms of pressure measurement and Calculate Hydrostatic Force and its Location for a given geometry and orientation of plane surface.
- Compute force of buoyancy on a partially or fully submerged body and analyse the stability of a floating body.
- Distinguish velocity potential function and stream function and solve for velocity and acceleration of a fluid at a given location in a fluid flow.
- Derive Euler's Equation of motion and Deduce Bernoulli's equation.
- Measure velocity and rate of flow using various devices.

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 4–5marks covering the entire syllabus.
3. The remaining five questions will be based on all the modules of the entire syllabus and may be. 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. Remaining questions will be mixed in nature (e.g. Suppose Q.2 has part (a) from module II then part (b) will be from any module other than module II).
5. The students will have to attempt any three questions out of remaining five questions.
6. 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 Orifice meter.
5. Determination of coefficient of discharge through Nozzle meter.
7. Determination of coefficient of discharge through Notches (Rectangular and Triangular notch).
8. Determination of coefficient of discharge over weirs (Broad Crested weir and Ogee weir).
9. Determination of hydraulic coefficients of orifice.
10. Determination of coefficient of discharge through mouthpiece.

Internal Assessment:

There will be two class tests (to be referred to as an 'Internal Assessment) to be conducted in the semester. The first internal assessment (IA) will be conducted in the mid of the semester based on the 40% of the syllabus. It will be of 20 marks. Similarly, the second internal assessment (IA) will be conducted at the end of the semester and it will be based on next 40% of the syllabus. It will be of 20 marks. Lastly, the average of the marks scored by the students in both the Internal Assessment will be considered. Duration of both the IA examination will be of one hour duration, respectively.

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 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. Broadly, the split of the marks for term work shall be as given below. However, there can be further bifurcation in the marks under any of the heads to account for any sub-head therein.

Report of the Experiments	:	10 Marks
Assignments	:	10 Marks
Attendance	:	05 Marks
Total	**:**	**25 Marks**

Further, while giving weightage of marks on the attendance, following guidelines shall be resorted to. 75% – 80%: 03 Marks; 81% – 90%: 04 Marks; 91% onwards: 05 Marks

Recommended Books:

1. Hydraulics and Fluid mechanics: *Dr. P.M. Modi and Dr. S.M. Seth*, Standard Book House, Delhi
3. Theory and Application of Fluid Mechanics: *K. Subramanian*, Tata McGraw hill publishing company, New Delhi.
4. Fluid Mechanics: *Dr. A.K Jain*, Khanna Publishers.
5. Fluid Mechanics and Hydraulics: *Dr. S.K. Ukarande*, Ane's Books Pvt. Ltd. (Revised Edition 2012), ISBN 97893 8116 2538
6. Fluid Mechanics and fluid pressure engineering: *Dr. D.S. Kumar*, F.K. Kataria and sons
7. 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.