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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)

Copy to :-

1. **The Deputy Registrar, Academic Authorities Meetings and Services (AAMS),**
2. **The Deputy Registrar, College Affiliations & Development Department (CAD),**
3. **The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),**
4. **The Deputy Registrar, Research Administration & Promotion Cell (RAPC),**
5. **The Deputy Registrar, Executive Authorities Section (EA),**
6. **The Deputy Registrar, PRO, Fort, (Publication Section),**
7. **The Deputy Registrar, (Special Cell),**
8. **The Deputy Registrar, Fort/ Vidyanagari Administration Department (FAD) (VAD), Record Section,**
9. **The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,**

They are requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to in the above circular and that on separate Action Taken Report will be sent in this connection.

1. **P.A to Hon'ble Vice-Chancellor,**
2. **P.A Pro-Vice-Chancellor,**
3. **P.A to Registrar,**
4. **All Deans of all Faculties,**
5. **P.A to Finance & Account Officers, (F.& A.O),**
6. **P.A to Director, Board of Examinations and Evaluation,**
7. **P.A to Director, Innovation, Incubation and Linkages,**
8. **P.A to Director, Board of Lifelong Learning and Extension (BLLE),**
9. **The Director, Dept. of Information and Communication Technology (DICT) (CCF & UCC), Vidyanagari,**
10. **The Director of Board of Student Development,**
11. **The Director, Department of Students Walfare (DSD),**
12. **All Deputy Registrar, Examination House,**
13. **The Deputy Registrars, Finance & Accounts Section,**
14. **The Assistant Registrar, Administrative sub-Campus Thane,**
15. **The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,**
16. **The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,**
17. **The Assistant Registrar, Constituent Colleges Unit,**
18. **BUCTU,**
19. **The Receptionist,**
20. **The Telephone Operator,**
21. **The Secretary MUASA**

for information.

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)

Preface

To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated 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) give freedom to affiliated Institutes to add few (PEO's) course objectives course outcomes to be clearly defined for each course, so that all faculty members in affiliated institutes understand the depth approach of course to be taught, which will enhance learner's learning process. It was also resolved that, maximum senior faculty from colleges 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, developed curriculum accordingly. In addition to outcome based education, semester based credit grading system is also introduced to ensure quality of engineering education.

Choice 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 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 Faculty of Technology has devised a transparent credit assignment policy adopted ten points scale to grade learner's performance. Credit grading based system was implemented for First Year of Engineering from the academic year 2016 – 2017. Subsequently this system will be carried forward for Second Year Engineering in the academic year 2017 – 2018, for Third Year and Final Year Engineering in the academic years 2018 – 2019, 2019 – 2020, respectively.

Dr. S. K. Ukarande
Co-ordinator,
Faculty of Technology,
Member - 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 taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education reflects the fact that in achieving recognition, the institution or program of study is committed 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 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 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 Multinational Organisations to excel in Postgraduate studies
4. To encourage motivate Learner's for self-learning
5. To inculcate professional ethical attitude, good leadership qualities 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 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 2017- 2018)

(Semester-III)

Subject Code	Subject 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		**18**	**8**	**1**	**18**	**4**	**1**	**23**

Subject Code	Subject 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

** For the course 'Surveying-I (CE-C 302)", the oral examination will be conducted in conjunction with practical/s

University of Mumbai
Scheme of Instructions and Examination

Second Year Engineering (Civil Engineering)

(With effect from 2017- 2018)

(Semester -IV)

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
CE-C401	Applied Mathematics-IV*	4	-	1	4	-	1	5
CE-C402	Surveying-II	3	3	-	3	1.5	-	4.5
CE-C403	Structural Analysis-I	4	2	-	4	1	-	5
CE-C404	Building Design & Drawing	2	3	-	2	1.5	-	3.5
CE-C405	Building Materials & Construction Technology	4	2	-	4	1	-	5
CE-C406	Fluid Mechanics-II	3	2	-	3	1	-	4
Total		**20**	**12**	**1**	**20**	**6**	**1**	**27**

Subject Code	Subject Name	Examination Scheme							
		Theory					TW	Oral & Practical	Total
		Internal Assessment			End Sem Exam	Exam Duration (in Hrs)			
		Test1	Test2	Avg.					
CE-C401	Applied Mathematics- IV*	20	20	20	80	3	25	--	125
CE-C402	Surveying-II	20	20	20	80	3	50	25**	175
CE-C403	Structural Analysis-I	20	20	20	80	3	25	25	150
CE-C404	Building Design & Drawing	20	20	20	80	4	25	25@	150
CE-C405	Building Materials & Construction Technology	20	20	20	80	3	25	25	150
CE-C406	Fluid Mechanics-II	20	20	20	80	3	25	25	150
Total		--	--	**120**	**480**	--	**175**	125	**900**

* Common with Mechanical/ Automobile/ Mechatronics

** For the course 'Surveying-II (CE-C 402), the oral examination will be conducted in conjunction with practical/s

@ For the course 'Building Design and Drawing (CE-C 404)', the oral examination shall be conducted in conjunction with the sketching examination.

University of Mumbai
Scheme of Instructions and Examination

Third Year Engineering (Civil Engineering)

(With effect from 2018- 2019)

(Semester -V)

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practs.	Tut.	Theory	Practs.	Tut.	Total
CE-C501	Structural Analysis – II	4	2	--	4	1	--	5
CE-C502	Geotechnical Engineering – I	3	2	--	3	1	--	4
CE-C503	Applied Hydraulics	3	2	--	3	1	--	4
CE-C504	Environmental Engineering -I	3	2	--	3	1	--	4
CE-C505	Transportation Engineering – I	3	2	--	3	1	--	4
CE-DLO506X	Department Level Optional Course – I	3	2	--	3	1	--	4
CE-C507	Business and Communication Ethics	--	4#	--	--	2	--	2
Total		**19**	**16**		**19**	**8**	**-**	**27**

Subject Code	Subject Name	Examination Scheme								
		Theory					Term Work	Practs.	Oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (In Hrs.)				
		Test 1	Test 2	Avg						
CE-C501	Structural Analysis-II	20	20	20	80	3	25	--	25	150
CE-C502	Geotechnical Engineering – I	20	20	20	80	3	25	--	25	150
CE-C503	Applied Hydraulics	20	20	20	80	3	25	--	25	150
CE-C504	Environmental Engineering -I	20	20	20	80	3	25	--	25	150
CE-C505	Transportation Engineering – I	20	20	20	80	3	25	--	25	150
CE-DLO506X	Department Level Optional Course -I	20	20	20	80	3	25	--	25	150
CE-C507	Business and Communication Ethics	--	--	--	--	--	50*	--	--	50
Total		**--**	**--**	**120**	**480**	**--**	**200**	**--**	**150**	**950**

University of Mumbai
Scheme of Instructions and Examination
Third Year Engineering (Civil Engineering)
(With effect from 2018- 2019)
(Semester -VI)

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract	Tut.	Theory	Practs	Tut.	Total
CE-C601	Geotechnical Engineering. – II	3	2	--	3	1	--	4
CE-C602	Design and Drawing of Steel Structures	4	2	--	4	1	--	5
CE-C603	Transportation Engineering. – II	3	2	--	3	1	--	4
CE-C604	Environmental Engineering. – II	3	2	--	3	1	--	4
CE-C605	Water Resource Engineering –I	3	2	--	3	1	--	4
CE-DLO606X	Department Level Optional Course – II	3	2	--	3	1	--	4
CE-C607	Software Applications in Civil Engineering	--	2	--	--	1	--	1
Total		**19**	**14**	**--**	**19**	**7**	**--**	**26**

Subject Code	Subject Name	Examination Scheme								
		Theory					Term Work	Pract.	Oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (InHrs.)				
		Test1	Test2	Avg						
CE-C601	Geotechnical Engineering-II	20	20	20	80	3	25	--	25	150
CE-C602	Design and Drawing of Steel Structures	20	20	20	80	4	25	--	25@	150
CE-C603	Transportation Engineering- II	20	20	20	80	3	25	--	--	125
CE-C604	Environmental Engineering-II	20	20	20	80	3	25	--	25	150
CE-C605	Water Resource Engineering-I	20	20	20	80	3	25	--	25	150
CE-DLO606X	Department Level Optional Course-II	20	20	20	80	3	25	--	25	150
CE-C607	Software Applications in Civil Engineering	--	--	--	--	--	25		25	50
Total		**120**	**120**	**120**	**480**		**175**	**--**	**150**	**925**

For the course 'Business and Communication Ethics (CE- C507), although 04 (Four) clock hours are mentioned under the head of Practical, 02 (Two) clock hours out of these 04 (Four) clock hours may be utilized as the Theory at the Institute/ College Level so as to enable the instructor (teacher) to impart the theoretical aspects of the said course. Accordingly, the provision may be made in the Time Table.

* Further, the oral examination in respect of the course 'Business and Communication Ethics (CE-C 507)' will be an internal oral and will be conducted in conjunction with seminar/ presentation.

@ For the course, Design and Drawing of Steel Structures (CE-C 602), the oral examination will be conducted in conjunction with sketching.

Department Level Optional Course –I	**Department Level Optional Course- II**
CE-DLO5061: Advanced Surveying	CE-DLO6061: Advanced Construction Equipment
CE-DLO5062: Advanced Concrete Technology	CE-DLO6062: Traffic Engineering and Management
CE-DLO5063: Building Services and Repairs	CE-DLO6063: Ground Improvement Techniques
CE-DLO5064: Advanced Structural Mechanics	CE-DLO6064: Advanced Structural Analysis

University of Mumbai
Scheme of Instructions and Examination
Fourth Year Engineering (Civil Engineering)
(With effect from 2019-2020)
(Semester -VII)

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practs.	Tut.	Theory	Pract.	Tut.	Total
CE-C701	Quantity Survey Estimation and Valuation	4	2	--	4	1	-	5
CE-C702	Theory of Reinforced Concrete Structures	4	--	2	4		2	6
CE-C703	Water Resource Engineering -II	3	--	2	3	--	2	5
CE-DLO704X	Department Level Optional Course-III	3	--	2	3	--	2	5
ILO701X	Institute Level Optional Course-I	3	--		3	--		3
CE-C705	Project – Part I	--	6	--	--	3	--	3
Total		**17**	**8**	**6**	**17**	**4**	**6**	**27**

Subject Code	Subject Name	Examination Scheme								
		Theory					Term Work	Pract	Oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (InHrs.)				
		Test1	Test 2	Avg						
CE-C701	Quantity Survey Estimation and Valuation	20	20	20	80	4	25	--	25	150
CE-C702	Theory of Reinforced Concrete Structures	20	20	20	80	3	25	--	25	150
CE-C703	Water Resource Engineering-II	20	20	20	80	3	25	--	25	150
CE-DLO704X	Department Level Optional Course-III	20	20	20	80	3	25	--	25	150
ILO701X	Institute Level Optional Course I	20	20	20	80	3	--	--	-	100
CE-P705	Project – Part I	--	--	--	--	--	50	--	25@	75
Total		**100**	**100**	**100**	**400**		**150**	**--**	**125**	**775**

@ For Project Part-I (CE-P 705), the oral examination shall be based on the presentation/ seminar before the board of internal examiners to be appointed by the Head of the concerned Department.

University of Mumbai
Scheme of Instructions and Examination
Fourth Year Engineering (Civil Engineering)
(With effect from 2019-2020)
(Semester- VIII)

Subject Code	Subject Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Practs	Tut.	Theory	Practs	Tut	Total
CE-C801	Design and Drawing of Reinforced Concrete Structures	4	2	--	4	1	-	5
CE-C802	Construction Management	4	2	--	4	1	-	5
CE-DLO803X	Department Level Optional Course- IV	4	2	--	4	1	--	5
ILO802X	Institute Level Optional Course- II	3	--	--	3	--	--	3
CE-P804	Project – Part II	--	12	--	--	6	--	6
Total		**15**	**18**	**-**	**15**	**9**	**-**	**24**

Subject Code	Subject Name	Examination Scheme								
		Theory					Term Work	Pract	Oral	Total
		Internal Assessment			End Sem Exam	Exam. Duration (In Hrs.)				
		Test1	Test 2	Avg						
CE-C801	Design and Drawing of Reinforced Concrete Structures	20	20	20	80	4	25	--	25	150
CE-C802	Construction Management	20	20	20	80	3	25	--	25	150
CE-DLO803X	Department Level Optional Course-IV	20	20	20	80	3	25	--	25	150
ILO802X	Institute Level Optional Course II	20	20	20	80	3	--	--	--	100
CE-P804	Project – Part II	--	--	--			50	--	50#	100
Total		**80**	**80**	**80**	**320**		**125**		**125**	**650**

The oral examination for the Project- Part II (CE-P 804) shall be based on the presentation/ seminar to be delivered by the projectee/s before the board of examiners. The board of internal examiners will comprise of the internal examiners and the external examiners to be approved by the University from the pool of eligible examiners.

Guidelines for Project, i.e., Dissertation (Part-I and II)

(i) Students can form groups with minimum of 2 (Two) students and not more than 4 (Four) students.
(ii) Faculty load: In Semester VII: 01 (One) clock hour per week per project group and in Semester VIII: 02 (Two) clock hours per week per project group.
(iii) Each faculty member shall be permitted to guide maximum 04 (Four) project groups.

Department Level Optional Course – III (Semester – VII)	**Department Level Optional Course – IV** (Semester – VIII)
CE-DLO7041: Pre-stressed Concrete CE-DLO7042: Solid Waste management CE-DLO7043: Pavement Sub-grade and Materials CE-DLO7044: Structural Dynamics CE-DLO7045: Application of GIS and Remote Sensing CE-DLO7046: Foundation Analysis and Design	CE-DLO8031: Advanced Design of Steel Structures CE-DLO8032: Industrial Waste Treatment CE-DLO8033: Pavement Design and Construction CE-DLO8034: Bridge Engineering and Design CE-DLO8035: Appraisal and Implementation of Infrastructure Projects CE-DLO8036: Soil Dynamics CE-DLO8037: Applied Hydrology and Flood Control

Institute Level Optional Course – I (Semester –VII)	**Institute Level Optional Course – II** (Semester – VIII)
ILO7011: Product Lifecycle Management ILO7012: Reliability Engineering ILO7013: Management Information Systems ILO7014: Design of Experiments ILO7015: Operations Research ILO7016: Cyber Security and Laws ILO7017: Disaster Management and Mitigation Measures ILO7018: Energy Audit and Management ILO7019: Development Engineering	ILO8021: Project Management ILO8022: Finance Management ILO8023: Entrepreneurship Development and Management ILO8024: Human Resources Management ILO8025: Professional Ethics and Corporate Social Responsibility (CSR) ILO8026: Research Methodology ILO8027: Intellectual Property Rights and Patenting ILO8028: Digital Business Management ILO8029: Environment Management

Semester III

	Semester III	
Subject Code	**Subject Name**	**Credits**
CE-C 301	Applied Mathematics–III	5

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 analyze engineering problems.
- To study the basic principles of Laplace Transform, Fourier Series, Complex variables

Details 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) $L\{t^n f(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\left\{\frac{d^n f(t)}{dt^n}\right\}$ Laplace Transform of Periodic functions	
	1.3	Inverse Laplace Transform: Linearity property, use of theorems to find inverse Laplace Transform, Partial fractions method and convolution theorem (without proof).	
	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 to be analytic (without proof), Cauchy-Riemann equations in polar coordinates.	
	2.2	Milne-Thomson method to determine analytic function when it's real or imaginary or its combination is given. Harmonic function, orthogonal trajectories.	
	2.3	Mapping: Conformal mapping, linear, bilinear mapping, cross ratio, fixed points and standard transformations such as Rotation and magnification, inversion and reflection, translation.	
III.	**3. Complex Integration**		**08**
	3.1	Line integral of a function of a complex variable, Cauchy's theorem for analytic functions (without proof) Cauchy's integral formula (without proof) Singularities and poles:	
	3.2	Taylor's and Laurent's series development (without proof)	
	3.3	Residue at isolated singularity and its evaluation.	
	3.4	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**		**10**
	4.1	Orthogonal and orthonormal functions, Expressions of a function in a series of orthogonal functions. Dirichlet's conditions. Fourier series of periodic function with period 2π & $2l$.	
	4.2	Dirichlet's theorem (only statement), even and odd functions, Half range sine and cosine series, Parsvel's identities (without proof)	

	4.3	Complex form of Fourier series.	
V.	**5. Partial Differential Equations**		**09**
	5.1	Numerical Solution of Partial differential equations using Bender-Schmidt Explicit Method, Implicit method (Crank- Nicolson method).	
	5.2	Partial differential equations governing transverse vibrations of an elastic string its solution using Fourier series.	
	5.3	Heat equation, steady-state configuration for heat flow.	
	5.4	Two and Three dimensional Laplace equations.	
VI.	**6. Correlation and Curve Fitting.**		**05**
	6.1	Correlation-Karl Pearson's coefficient of correlation- problems. Spearman's Rank correlation problems, Regression analysis- lines of regression (without proof) –problems	
	6.2	Curve Fitting: 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

After completion of the course, students will be able to..

- Demonstrate the ability of using Laplace Transform in solving the Ordinary Differential Equations and Partial Differential Equations.
- Demonstrate the ability of using Fourier Series in solving the Ordinary Differential Equations and Partial Differential Equations.
- Solve initial and boundary value problems involving ordinary differential equations.
- Identify the analytic function, harmonic function, orthogonal trajectories.
- 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

7. Fundamentals of mathematical Statistics by S.C.. Gupta and Kapoor

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.	**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.	**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.	**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.	**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.	**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.	**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 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 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.	
	3.2Strain 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 anythree 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 JaanKiusalaas*, 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:

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.

Report of the Experiments	:	10 marks
Assignments	:	07marks
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 VidyarthiGrihaPrakashan,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**		**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		
II.	**2. Fluid Statics**		**10**
	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 & 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.

Semester IV

Semester IV		
Subject Code	**Subject Name**	**Credits**
CE-C 401	Applied Mathematics–IV	5

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 inculcate an ability to relate engineering problems to mathematical context
- To provide a solid foundation in mathematical fundamentals required to solve engineering problem
- To study the basic principles of Vector analyses, complex integration, probability, test of hypothesis and correlation between data.
- To prepare students for competitive exams

Detailed Syllabus			
Module	**Sub-Modules/ Contents**		**Periods**
I.	**1. Matrices**		**08**
	1.1	Brief revision of vectors over a real field, inner product, norm of a vector	
	1.2	Eigen values and Eigen vectors: 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, Cayley Hamilton theorem (without proof). Similarity of matrices. Functions of a square matrix	
II.	**2. Matrices**		**09**
	2.1	Minimal polynomial and Derogatory matrix.	
	2.2	Quadratic forms: Linear transformations of a quadratic form, congruence of a square matrix, reduction to Canonical form under congruent transformations, orthogonal transformations, determining the nature of a quadratic form, Applications of Eigen Values and Eigen Vectors	
		Vector calculus	
	2.3	Brief revision of Scalar and vector point functions. Gradient of a scalar function, Divergence and curl of a vector function.	
	2.4	Line integrals, circulation of a vector, condition for independence of the path in the line integral.	
III.	**3. Vector calculus**		**09**
	3.1	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), Linear Programming problems.	
	3.2	Types of solutions to linear programming problems, standard form of L.P.P. Simplex method to solve L.P.P.	
IV.	**4. Linear Programming Problems Probability Distributions**		**09**
	4.1	Big M method (Penalty method) to solve L.P.P, Duality, Dual simplex method and Revised simplex method to solve L.P.P., Probability Distributions	
	4.2	Discrete and Continuous random variables, Probability mass and density	

		function, Probability distribution for random variables, Expected value, Variance.	
	4.3	Probability Distributions: Binomial, Poisson and Normal Distributions.	
V.	**5. Sampling theory**		**09**
	5.1	Sampling theory: 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.	
	5.2	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.	
	5.3	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	
VI.	**6. Sampling theory and ANOVA**		**08**
	6.1	Chi-square test, Test for the Goodness of fit, Association of attributes and Yate's correction	
	6.2	Analysis of Variance(F-Test): One-way classification, Two-way classification (short-cut method)	
		Total	**52**

Contribution to Outcomes

After learning the topics, the students will be able to:

- Solve the system of linear equations using matrix algebra with its specific rules
- Demonstrate basics of vector calculus
- Apply the concept of probability distribution and sampling theory to engineering problems
- Apply principles of vector calculus to the analysis of engineering problems
- Identify, formulate and solve engineering problems
- Illustrate basic theory of correlations and regression

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.

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 write at least 6 class tutorials on entire syllabus.

Recommended Books:

1. Advanced Engineering Mathematics, E Kreyszing, Wiley Eastern Limited
2. Higher Engineering Mathematics, B. S. Grewal, Khanna Publication
3. Advanced Engineering Mathematics, H. K. Dass, S. Chand & co
4. Vector Analysis by Murray R. Spiegel, Shaum Series
5. Operations Research, S.D. Sharma, S. Chand & CO.
6. Fundamentals of Mathematical Statistics, S C Gupta & V K Kapoor, S. Chand & Co
7. Elements of Applied mathematics, P N & J N Wartikar, Pune Vidyarthi Gruha Prakashan
8. Advanced Engineering Mathematics, E Kreyszing, Wiley Eastern Limited
9. Operations Research, Kantiswearup, Manmohan, P K Gupta, S. Chand & CO

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.	50	-	25	175

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 Total Station, G.P.S., G.I.S. and remote sensing techniques. To make the students acquainted with the field problems, a 4-day survey camp is arranged to execute the Road project, Block contouring project, Tachometric project and Total Station Traversing at ideal locations.

Objectives

- To understand operation of Total Station, EDM, Electronic Theodolite for desired accuracy in surveying.
- To learn how to establish survey control of determined accuracy using GPS, GIS and Remote sensing.
- To Study various types of curves by linear and angular methods.
- To prepare different layout from surveying data.
- To learn how to generate and manipulate field survey data and incorporate design data using specialized softwares.

Detailed Syllabus			
Module	**Sub-Modules/ Contents**		**Periods**
I.	**Curves-Horizontal**		**10**
	1.1	Definitions of different terms, necessity of curves and types of curves	
	1.2	Simple circular curves, office and field work, linear and angular methods of setting out simple circular curves, problems on simple circular curve, compound curves, their needs and various types	
	1.3	Reverse and transition curves, their properties and advantages, design of transition curves, shift, spiral angle. Composite curves office and field work. Setting out of curves by angular method, composite curves problems.	
	1.4	Difficulties in setting out curves and solution for the same.	
II.	**Curves-Vertical**		**3**
	2.1	Tangent correction and chord gradient methods, , problems on the same	
	2.2	Sight distance on a vertical curve, problems on the same	
III.	**Setting out works**		**4**
	3.1	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	
	3.2	Setting out a foundation plans for building, sewer line, culvert, and use of laser for works; Setting out centre line for tunnel, transfer of levels for underground works.	
	3.3	Project/route survey for bridge, dam and canal;Checking verticality of high rise structures.	
IV.	**Special Survey Instruments**		**6**
	4.1	**Electronic Theodolite, Total Station**: Principles, Types, Applications, Topographical Survey and Stake-out, Transferring data to and from other software's for further processing, advantages and limitations	
	4.2	Introduction to Site square, Penta Graph, Auto-set Level, Transit level, Special Compasses, Brunton's Universal Pocket Transit, Mountain Compass Transit	

V.	**Modern Methods of Surveying**		**12**
	5.1	**Global Positioning System (GPS)**:Basic principles, GPS segments, receivers, computations of coordinates, Applications in surveying	
	5.2	**Remote Sensing**: Definition, basic concepts, electromagnetic radiation and spectrum, energy source and its characteristics, image acquisition and image interpretation. Application of remote sensing.	
	5.3	**Geographical Information System (GIS)**: Geographical concepts and terminology, advantages, basic components of GIS, data types, GIS analysis, Applications of GIS.	
	5.4	**Field Astronomy**: Introduction, purposes, astronomical terms, determination of azimuth, latitude, longitude and time corrections to the observations.	
	5.5	**Aerial photogrammetry**: Introduction, Principle, Uses, Aerial camera, Aerial photographs, Definitions, Scale of vertical and tilted photograph, Ground Co-ordinates, Displacements and errors, Ground control, Procedure of aerial survey, Photomaps and mosaics, Stereoscopes, Parallax bar	
	5.6	**Hydrographic Survey:** Introduction, Organizations, National and International Maritime Hydrography, Hydrographic survey Methods, Lead lines, sounding poles, and single-beam, echo sounders.	
VI.	**Cadastral Surveying**		**4**
	6.1	Interpreting and advising on boundary locations, on the status of land ownership and on the rights, restrictions and interests in property. Legal requirements relating to property boundary surveys in India	
	6.2	Role of revenue department in maintaining survey records, introduction to local survey terminologies like tehsildar, 7/12, utara, namuna8, etc. Introduction to Survey of India Department; Department of Registration and Stamps, Maharashtra	
		Total	**39**

Contribution to Outcomes

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

- Operate Total Station & GPS for desired accuracy in surveying and establish survey control of determined accuracy using Total Station, GPS, GIS and remote sensing.
- Set out various types of curves by linear and angular methods
- Compute setting out data from survey and design information.
- Generate and manipulate field survey data and incorporate design data using specialised software's.
- Appreciate the role of various governmental authorities in maintaining cadastral survey records.

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 shall be based on the entire syllabus, the projects performed and practicals conducted. It will include a practical exam (10 marks) before proceeding for viva (15 marks)

List of Practicals:

1. To set out circular curve by linear methods.
2. To set out circular curve by angular methods.
3. Determination of horizontal and vertical distances, bearings and area using Total Station.
4. Determination of co-ordinates of a traverse, length of traverse lines using GPS
5. Post-processing of data obtained in Total Station & GPS practical using softwares like *TERRAMODEL*, *AutoCAD* etc. and print out the sheets
6. Analysis of survey projects conducted using computer by applying various softwares like MS excel, SurveyOS, surfit, QuikGrid, etc.
7. Setting out a simple foundation plan in the field.

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:

1. **Project I:** Road project using Auto level for a minimum length of 500 m including fixing of alignment, Profile levelling, cross-sectioning, at least one simple and one reverse curve, plotting of L section and Cross Section. (Two full imperial sheet including plan, L–section and any three typical Cross-sections, sample data computation for curves, cutting and filling required
2. **Project II**: Block Contouring project using Auto level for minimum 100 × 80 m area and generating contours by MS Excel, etc. (minimum contour interval 0.2 meter)
3. **Project III:** Tachometric contouring project on hilly area with at least two instrument stations about 60 m to 100 m apart and generating contours using software such as Autodesk land desktop, Auto civil, Foresight etc. (minimum contour interval 1 meter)
4. **Project IV:** Traversing using a total station (minimum 10 acres' area)
5. The account of practicals performed with aim, apparatus, observations, calculations, results and inferences
6. Field book submission on afore-mentioned practicals conducted on and off the field.
7. The assignments shall comprise of the minimum 5 problems covering the entire syllabus, theory questions on each chapter

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 performance	:	15 marks
Project (04)	:	20 marks
Attendance (Theory and Tutorial)	:	05 marks
Total	**:**	**50 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: *R. Agor*, Khanna Publishers, New Delhi
2. Surveying and Levelling: *N N. Basak*, Tata McGraw Hill, New Delhi.
3. Surveying and Levelling, Vol-I and II: *Kanetkar and Kulkarni*, Pune VidyarthiGriha, Pune.
4. Surveying, Vol-I, II & III: *Dr K.R. Arora*, Standard Book House.
5. Surveying and Levelling, (2Edition): *R. Subramanian*; Oxford Higher Education.
6. Surveying and levelling, Vol.-I, II & III: *Dr. B.C. Punmia*, Laxmi Publications.
7. Surveying and Levelling, Vol.-I& II:*S. K.Duggal*, Tata Mc-Graw Hill
8. Advanced Surveying, *R. Agor*, Khanna Publishers, New Delhi
9. Fundamentals of Surveying, *S.K. Roy*, Prentice Hall India, New Delhi
10. Remote Sensing and GIS, *B Bhatta*, Oxford University Press, New Delhi.
11. Remote sensing and Image interpretation, *T.M Lillesand, R.W Kiefer andJ.W Chipman*, 5th edition, John Wiley and Sons India
12. Concepts and Techniques of Geographic Information Systems, *Lo, C.P. &Yeung A.K.W*., Prentice Hall of India, New Delhi, 2002
13. Remote Sensing and Geographical Information Systems. *Anji Reddy*, B.S.Publications, Hyderabad, 2001.

Web Materials:

1. http://nptel.ac.in/courses/105104100/1
2. http://www.surveyofindia.gov.in/
3. http://igrmaharashtra.gov.in/#

Semester IV		
Subject Code	**Subject Name**	**Credits**
CE-C 403	Structural Analysis–I	5

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	-	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 behavior 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 center and its application in solving the problems of structural mechanics.

Detailed Syllabus		
Module	**Sub- Modules/ Contents**	**Periods**
I.	**1.1 Axial force, shear force and bending moment**	**6**
	Concept of statically determinate structures; Axial force, shear force and bending moment diagrams for statically determinate frames with and without internal hinges.	
	1.2. General theorems and its application to simple structures	**3**
	General theorems and principles 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.	**2. Deflection of Statically Determinate Structures Using Geometrical Methods**	**7**
	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.	**3. Deflection of Statically Determinate Structures Using Methods Based on Energy Principle**	**9**
	3.1 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.	
	3.2 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.	
	3.3 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 intrusses.	
IV.	**4.1 Rolling Load and Influence Lines for Statically Determinate Structures**	**8**
	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.	

	4.2 Three Hinged Elastic Arches	**5**
	Determination of normal thrust, radial shear and bending moment for parabolic and circular (semi and segmental) three hinged arches, Influence lines for normal thrust, radial shear and bending moment for three hinged parabolic arch.	
V.	**5. Cables, Suspension bridges and Three Hinged Stiffening Girder**	**4**
	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.	**6.1 Columns and Struts**	**4**
	Columns and struts subjected to eccentric loads, Secant formula, Perry's formula, struts with initial curvature.	
	6.2 Unsymmetrical bending	**3**
	Product of inertia, principal moment of inertia, flexural stresses due to bending in two planes for symmetrical sections, bending of unsymmetrical sections.	
	6.3 Shear Centre	**3**
	Shear centre for thin walled sections such as channel, tee, angle section and I-section.	
	Total	**52**

Contribution to Outcomes

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

- Understand the behavior of various statically determinate structures including compound structures having an internal hinge for various loadings.
- Analyze these structures to find out the internal forces such as axial force, shear force, bending moment, twisting moments, etc.
- 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.
- Analyze the structures such as arches and suspension bridges and study the behavior of eccentrically loaded columns.
- Analyze the section with respect to unsymmetrical bending and shear center.
- 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 4-5marks 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 shall be based upon the entire syllabus and the term work consisting of the assignments.

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.

Assignments	:	20 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. 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. Structural Analysis I: *Hemant Patil, Yogesh Patil, Jignesh Patel*, Synergy Knowledgeware, Mumbai.
7. Strength of Materials*: Rajput*, S. Chand Publications, Delhi
8. Structural Analysis: *Bhavikatti*, Vikas publisher house Pvt, ltd.
9. Structural Analysis: *DevdasMenon*, Narosa Publishing House.
10. Basic Structural Analysis: K.*U. Muthu, Azmi Ibrahim, M. Vijyanand, MagantiJanadharnand. I.K.* International Publishing House Pvt. Ltd.
11. Comprehensive Structural Analysis: Vol-I and II by *Vaidyanathan R. and Perumal R.*Laxmi Publications.
12. Elementary Structural Analysis: *Jindal*
13. Structural Analysis: *L.S. Negi and R.S. Jangid,* Tata Mc-Graw Hill India
14. Fundamentals of Structural Analysis: *Sujit Kumar Roy and SubrotaChakrabarty*, S. Chand Publications.
15. Structural Analysis: *T.S. Thandavamoorthy*, Oxford University Press.
16. Structural Analysis: *Manmohan Das, Bharghab Mohan*Pentice Hall International.

Reference Books:

1. Structural Analysis: *Hibbler*, Pentice Hall International.
2. Structural Analysis: *Chajes*, ElBS London.
3. Theory of Structures: *Timoshenko and Young*, Tata McGraw Hill New Delhi.
4. Structural Analysis: *Kassimali*, TWS Publications.
5. Element of Structural Analysis: *Norries and Wilbur*, McGraw Hill.
6. Structural Analysis: *Laursen H.I*, McGraw Hill Publishing Co.
7. Structural theorem and their application: *B.G. Neal*, Pergaman Press.
8. Fundamentals of Structural Analysis: *K.M. Leet*, C.M. Uang and A.M. Gilbert, Tata McGraw Hill New Delhi.
9. Elementary theory of Structures: *Hseih*, Prentice Hall.

Semester IV		
Subject Code	**Subject Name**	**Credits**
CE-C 404	Building Design and Drawing	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

Drawing is the language civil engineers communicate in. Drawing is one of the most essential documents as far as civil engineering is concerned. It provides guidance and instructions to architects, engineers and workmen at field on how to construct structures according to the figures and dimensions shown in the drawing. Approved drawings are also essential for the estimation of cost and materials; as well as a very important contract document.

Objectives

- To remember and recall the intricate details of building design and drawing.
- To gain an understanding of the basic concepts of building design and drawing.
- To learn how to apply professional ethics and act responsibly pertaining to the norms of building design and drawing practices.
- To identify, analyse, research literate and solve complex building design and drawing problems.
- To design new solutions for complex building design and drawing problems.
- To effectively communicate ideas related to building design and drawing, both orally as well as in written format like reports & drawings.

Detailed Syllabus			
Module	**Sub- Modules/ Contents**		**Periods**
I.	**1. Principles and Codes of Practices for Planning and Designing of Buildings**		**9**
	1.1	Study of IS 962: 1989 – Code of Practice for Architectural and Building Drawings	
	1.2	Principles of planning for residential buildings	
	1.3	Classification of buildings	
	1.4	Study of building Bye-laws and documents / permissions required from commencement to completion of the building according to National Building Code (N.B.C.) of India and local Development Control (D.C.) rules	
	1.5	Study of sun path diagram, wind rose diagram and sun shading devices	
	1.6	Calculation of setback distances, carpet area, built-up area and floor space index (FSI)	
	1.7	Principles of planning for public buildings: i) Building for education: schools, colleges, institutions, libraries etc. ii) Buildings for health: hospitals, primary health centres etc. iii) Office buildings: banks, post offices, commercial complexes etc. iv) Building for public residence: hostels, boarding houses etc.	
II.	**2. Components and Services of a Building**		**5**
	2.1	Staircase (dog legged & open newel in details),	
	2.2	Foundations: stepped footing, isolated sloped footing and combined footing	
	2.3	Openings: doors and windows	
	2.4	Types of pitched roof and their suitability (plan and section)	
	2.5	Building services: Water supply, sanitary and electrical layouts	
III.	**3. Perspective Drawing**		**4**
	3.1	One-point perspective	
	3.2	Two-point perspective	
IV.	**4. Town Planning, Architectural Planning & Built Environment**		**4**
	4.1	Objectives and principles (road systems, zoning, green belt etc.)	
	4.2	Master plan and slum rehabilitation	
	4.3	Architectural Planning: introduction and principles	

	4.4	Built Environment: introduction and principles	
V.	**5. Green Buildings**		**2**
	5.1	Introduction and overview	
	5.2	Certification methods (LEED and TERI)	
VI.	**6. Computer Aided Drawing (CAD)**		**2**
	6.1	Advantages of CAD	
	6.2	Overview of any one of the CAD software's prevailing in the market (AutoCAD, Revit, 3D Max etc.)	
		Total	**26**

Contribution to Outcomes

- Students will be able to list down the types of structures and its various components (for eg. doors, windows, staircase, foundations etc.)
- Students will be able to explain various concepts pertaining to building design and drawing (for eg, principles of planning, architectural planning, green buildings etc.)
- Students will be able to apply principles of planning, architectural planning and building bye laws while designing and preparing building drawings.
- Students will be able to calculate and analyze various technical details of a building (for eg. carpet area, FSI etc.) from its drawings.
- Students will be able to design various components of buildings (for eg. staircases etc.) as well as buildings as a whole, given the requirements of the building owner and local D.C. laws.
- Students will be able to prepare drawings (for eg. plans, elevation, perspective views etc.) of the designed components of buildings as well as buildings as a whole.

Theory Examination:

1. Question paper will consist of total 6 questions; each carrying 20 marks.
2. Question no. 1 will be compulsory and based on drawing work of any one building, maybe residential or public building
3. Any 3 out of the remaining 5 questions need to be attempted.
4. In question paper, weightage of each module maybe approximately proportional to the number of lecture hours assigned to it in the syllabus.

Practical Examination (Oral and Sketching)

Practical examination will consist of sketching and oral examination based on the entire syllabus.

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

Reports:

1. Summary of Development Control (D.C.) rules of student's own or nearest city
2. Summary of documents required from commencement to completion of the building by the concerned local body i.e. Municipal Corporation or nearest Municipality.
3. One-day site visit could be arranged for students to visit any one public building near the college like commercial complex, library, Bank etc. They need to study in detail of that building take the measurements of that building should submit as a site report with detailed drawing according to some suitable scale. This will become a part of Term Work.

Drawings:

1. Ground floor plan, first floor plan, elevation, section passing through at least one sanitary unit & staircase, site plan, schedule of opening and construction notes of a residential building (bungalow or apartment) to be constructed as a (G+1) R.C.C. framed structure
2. Ground floor plan, first floor plan, elevation, section passing through at least one sanitary unit & staircase, site plan, schedule of opening and construction notes of a public building (school or hostel or hospital or bank) be constructed as a (G+1) R.C.C. framed structure
3. Roof plan, foundation plan (with section of a typical foundation), plan and section of staircase, one typical door and one typical window of either one of the two above drawings
4. One point and two-point perspective
5. CAD sheet of either one of the first two drawings

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.

Drawing Sheets	:	10 Marks
Report of the Drawing	:	05 Marks
Report on the Site Visit	:	05 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. Building Drawing with an Integrated Approach to Built Environment by *M. G. Shah, C. M. Kale, S. Y. Patki* (Tata McGraw-Hill Education)
2. Civil Engineering Drawing (including Architectural aspect) by *M. Chakraborti* (Monojit Chakraborti Publications, Kolkata)
3. Planning and Designing Buildings by *Y.S.Sane* (Modern Publication House, Pune)
4. Building Drawing and Detailing by *B.T.S. Prabhu, K.V. Paul and C.V.Vijayan* (SPADES Publication, Calicut)
5. Building Planning by *Gurucharan Singh* (Standard Publishers & Distributors, New Delhi)

References:

1. IS 962: 1989 – Code of Practice for Architectural and Building Drawings.
2. National Building Code of India – 2005 (NBC 2005)
3. Development Control Regulations for Mumbai Metropolitan Region for 2016 – 2036 (https://mmrda.maharashtra.gov.in/documents/10180/7761832/5.pdf/e09991a2-b29e-4e04-a33e-a40aca6e2689?version=1.1)
4. Development Control Regulations for Navi Mumbai Municipal Corporation – 1994 (https://www.nmmc.gov.in/development-control-regulations)
5. Development Plan and Control Regulation for 27 villages of Kalyan and Ambernath tehsils of Thane district, Maharashtra (https://mmrda.maharashtra.gov.in)

Semester IV		
Subject Code	**Subject Name**	**Credits**
CE-C 405	Building Materials and Construction Technology	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

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, uses of different types of building materials and the selection of materials, its mix proportioning, mixing, placing, compacting, curing and finishing. 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 masonry, roof and floor, staircase etc., their functions and methods of construction so as to achieve good knowledge about building construction.
- To study the properties such as workability, durability and porosity of fresh and hardened concrete.
- To understand the concept and optimization of mix design for different environmental conditions.

Detailed Syllabus			
Module	**Sub-Modules/ Contents**		**Periods**
I.	**Introduction** Classification of materials, building materials symbols and requirements of building materials and products: functional, aesthetical and economical		**4**
II.	**Manufacturing Process and Properties of Basic Construction Materials.**		**11**
	2.1	Rocks (Stone) quarrying, milling and surface finishing, preservative treatments. **Aggregate-**Properties of coarse and fine aggregates and their influence on properties of concrete, properties of crushed aggregates.	
	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: Manufacturing process and physical properties, plaster of Paris -properties and uses.	
	2.5	**Mortar** -ingredients, preparation and uses.	
	2.6	Damp -proofing and water proofing materials	
III.	3.1	**Concrete**	**09**
		Grades of concrete, Manufacturing process, Properties of fresh and hardened concrete. Durability -Factors affecting durability, Relation between durability and permeability, laboratory tests on durability such as Permeability test, Rapid chloride penetration test.	
	3.2	**Admixtures**: Plasticizers, Super-plasticizers, Retarders, Accelerators, Mineral admixtures and other admixtures, test on admixtures, chemistry and compatibility with concrete.	
IV.	4.1	**Glass**: Types and uses. Introduction to glass fibre reinforced plastic.	**04**
	4.2	**Timber**: Varieties, defects in timber, preservative treatments and wood composites.	
V.	5.1	**Concrete mix design** Types of mix, 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 (revised code)	**10**

	5.2	**Ready mix concrete**: Advantages of RMC, components of RMC plant, distribution and transport, handling and placing, mix design of RMC, Mass Concerting, Vaccum Concerting and Concreting Equipments	
VI.	6.1	**Masonry Construction and Masonry Finishes**: Classification and bonding of stone, brick and concrete blocks Masonry finishes -pointing, plastering and painting	**14**
	6.2	**Formwork** Materials used, design considerations, shuttering, centering and staging, scaffolding. Types of form work: Slip form work, Cantilever and other modern form work	
	6.3	**Floor and roof** Different types and its suitability. Type of roofs, wooden and steel trusses and roof covering Different types of cladding.	
		Total	**52**

Contribution to Outcomes

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

- Identify and list the various building materials, their properties and symbols.
- Identify the properties of ingredients of concrete, interpret and design concrete mix for various grades.
- Explain and interpret manufacturing process of basic construction materials and understand various masonry construction and finishes.
- Perform tests on various materials.

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 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.

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.

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

1. Physical properties of cement: Fineness, consistency, setting time, Soundness, Compressive strength.
2. Water absorption and compressive strength test of bricks.
3. Water absorption and transverse load test on tiles.
4. Compression test on timber (Parallel/ perpendicular to the grains).
5. Effect of w/c ratio on workability, (slump cone, compaction factor, V-B test, flow table) and strength of concrete
6. Effect of w/c ratio on strength of concrete,
7. Study of admixtures and their effect on workability and strength of concrete
8. Secant modulus of elasticity of concrete and indirect tensile test on concrete
9. Nondestructive testing of concrete- some applications (hammer, ultrasonic)
10. Mix design in laboratory.

Site Visit/ Industrial Visit:

The students shall visit the brick, paver blocks, concrete block, cement, glass and RMC industrial plants. They shall study various aspects of the plant along with various operations. A visit may also be arranged to the site involving repairs and rehabilitation of concrete structures. 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 **08** 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.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	:	05 Marks
Sketches	:	05 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. Building Construction: *S. P. Bindra and S. P. Arora*, Dhanpat Rai and Sons, Delhi.
2. Engineering Materials: S.*R. Rangwala,* Charotar Publications.
3. Building Construction: *Rangwala*, Charotar Publications, Anand (Gujrat).
4. Concrete Technology Theory and Practice: Shetty M.S., S. Chand.
5. Concrete Technology: Gambhir M.L., Tata McGraw Hill, New Delhi.
6. Concrete Technology: Neville A.M. & Brooks. J. J., ELBS-Longman.
7. Concrete mix proportioning-guidelines (IS 10262:2009).
8. Concrete Technology: *A. R. Shanthakumar*, Oxford University Press.
9. Engineering Materials: S.*R. Rangwala,* Charotar Publications.
10. Materials of Construction: *D. N. Ghose*, Tata McGraw Hill, Delhi.
11. Architectural Materials science*: D. Anapetor*, Mir Publishers.
12. Introduction to Engineering Materials: *B. K. Agrawal*, Tata McGraw Hill NewDelhi.
13. Engineering Materials: *P. Surendra Singh*, Vani Education Books New Delhi.
14. Building Materials (Products, Properties and Systems): *M.L. Gambhir and NehaJamwal*, Mc-Graw Hill Publications.
15. Specifications for different materials, BIS Publications, New Delhi
16. Properties of concrete: Neville, Isaac Pitman, London.
17. Relevant I.S. codes: Bureau of Indian standard.

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

- To understand the Pipe flow problems, losses incurred during transmission of power through pipe and nozzle.
- To study hardy cross method and water hammer phenomenon
- To study and analyze the pipe network which will help to design water supply schemes.
- To study laminar, turbulent flows and its significance.
- To study compressible flow and understand boundary layer theory.

Detailed Syllabus			
Module	**Sub-module /Content**		**Periods**
I	**1. Flow through pipes:**		**10**
	1.1	**Flow through pipes:** Loss of head through pipes, Darcy-Weisbach equation, minor and major losses. 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.	
	1.2	**Pipe network and water hammer:** Hardy cross method, water hammer in Pipes-Gradual closure and instantaneous closure of valve control measures.	
II	**2. Flow through nozzles:**		**04**
	Power transmitted through nozzle, condition for maximum power transmitted, diameter of nozzle for maximum transmission of power.		
III	**3. Compressible flow:**		**05**
	Basic equation of flow (elementary study), velocity of sound or pressure wave in a fluid, Mach number, propagation of pressure waves, area-velocity relationship, Stagnation properties.		
IV	**4. Boundary layer theory:**		**07**
	Development of boundary layer over flat surfaces. Boundary layer thickness, energy thickness and momentum thickness, Boundary layer separation and control. Introduction to flow around submerges body, drag and lift, terminal velocity of body		
V	**5. Laminar Flow:**		**05**
	Reynolds experiment, critical velocity, laminar flow through circular pipes, flow between two parallel plates: stationary and moving. Kinetic energy correction factor, and momentum correction factor. Dash pot mechanism.		
VI	**6. Turbulent Flow:**		**08**
	Causes of turbulence, shear stress in turbulent flow, Prandtl's mixing length Theory, Hydro dynamically smooth and rough pipes, velocity distribution in smooth and rough pipes, Karman-Prandtl velocity distribution equation, Resistance to flow in smooth and rough pipes, resistance equation and Moody's diagram.		
		Total	**39**

Contribution to Outcomes

- On completion of this course the student will be able to:
- Interpret different pipe fittings and evaluate the fluid velocity considering major and minor losses.
- Solve pipe network problems by Hardy cross method.
- Distinguish the types of compressible flow and understand concept of boundary layer theory.
- Evaluate pressure drop in pipe flow using Hagen-Poiseuille's equation for laminar flow in a pipe.
- Establish Prandtl's mixing theory and solve turbulent flow 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 4-5marks 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 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 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 on 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.
2. Theory and Application of Fluid Mechanics: *K. Subramanya*, Tata McGraw hill publishing company.
3. Fluid Mechanics: *Dr. A.K Jain*, Khanna Publishers.
4. Fluid Mechanics and fluid pressure engineering: *Dr. D.S. Kumar, F.K. Kataria.*
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.