

University of Mumbai



No. AAMS(UG)/ 09 of 2022-23

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges, Directors of the Recognized Institutions in Faculty of Science & Technology is invited to this office circular No. UG/48 of 2021 dated 21st January, 2021 relating to the Scheme (Sem. III to VIII) and revised syllabus (Rev-2019 'C' Scheme) for the B.E. in Civil Engineering (Sem. III & IV).

They are hereby informed that the recommendations made by the Board of Studies in Civil Engineering at its meeting held on 18th November, 2021 and subsequently passed by the Board of Deans at its meeting held on 27th December 2021 vide item No. 6.1 have been accepted by the Academic Council at its meeting held on 28th December, 2021 vide item No. 6.1 and that in accordance therewith, the reduced syllabus for B.E. (Civil Engineering) (Rev-2019 'C' Scheme for Direct Second Year (Sem.III) as Direct Second Year (DSE) students admission is delayed by the six months due to COVID-19 situation, has been brought into force with effect from the academic year 2021-22 only. (The same is available on the University's website www.mu.ac.in).

MUMBAI – 400 032

4th May, 2022

To

(Sudhir S. Puranik)
REGISTRAR

The Principals of the Affiliated Colleges, and Directors of the Recognized Institutions in Faculty of Science & Technology.

A.C/6.1/28/12/2021

No. AAMS(UG)/ 09 -A of 2022-23

4th May, 2022

Copy forwarded with Compliments for information to:-

- 1) The Dean, Faculty of Science & Technology,
- 2) The Chairman, Board of Studies Civil Engineering,
- 3) The Director, Board of Examinations and Evaluation,
- 4) The Director, Board of Students Development,
- 5) The Director, Department of Information & Communication Technology,
- 6) The Co-ordinator, MKCL.

(Sudhir S. Puranik)
REGISTRAR

Copy for information and necessary action :-

1. The Deputy Registrar, College Affiliations & Development Department (CAD),
2. College Teachers Approval Unit (CTA),
3. The Deputy Registrar, (Admissions, Enrolment, Eligibility and Migration Department (AEM),
4. The Deputy Registrar, Academic Appointments & Quality Assurance (AAQA)
5. The Deputy Registrar, Research Administration & Promotion Cell (RAPC),
6. The Deputy Registrar, Executive Authorities Section (EA)
He is requested to treat this as action taken report on the concerned resolution adopted by the Academic Council referred to the above circular.
7. The Deputy Registrar, PRO, Fort, (Publication Section),
8. The Deputy Registrar, Special Cell,
9. The Deputy Registrar, Fort Administration Department (FAD) Record Section,
10. The Deputy Registrar, Vidyanagari Administration Department (VAD),

Copy for information :-

1. The Director, Dept. of Information and Communication Technology (DICT), Vidyanagari,
He is requested to upload the Circular University Website
2. The Director of Department of Student Development (DSD),
3. The Director, Institute of Distance and Open Learning (IDOL Admin), Vidyanagari,
4. All Deputy Registrar, Examination House,
5. The Deputy Registrars, Finance & Accounts Section,
6. The Assistant Registrar, Administrative sub-Campus Thane,
7. The Assistant Registrar, School of Engg. & Applied Sciences, Kalyan,
8. The Assistant Registrar, Ratnagiri sub-centre, Ratnagiri,
9. P.A to Hon'ble Vice-Chancellor,
10. P.A to Pro-Vice-Chancellor,
11. P.A to Registrar,
12. P.A to All Deans of all Faculties,
13. P.A to Finance & Account Officers, (F & A.O),
14. P.A to Director, Board of Examinations and Evaluation,
15. P.A to Director, Innovation, Incubation and Linkages,
16. P.A to Director, Department of Lifelong Learning and Extension (DLLE),
17. The Receptionist,
18. The Telephone Operator,

Copy with compliments for information to :-

19. The Secretary, MUASA
20. The Secretary, BUCTU.

UNIVERSITY OF MUMBAI



**Bachelor of Engineering
(Civil Engineering)**

**Direct Second Year (Sem. III) Admitted Students for
the current Academic Year 2021-22 Only due to
Covid Pandemic**

(REV- 2019 'C' Scheme) from Academic Year 2019 – 20

**Under
FACULTY OF SCIENCE & TECHNOLOGY**

Program Structure for Second Year Engineering
Semester III & IV
UNIVERSITY OF MUMBAI
(With Effect from 2020-2021)
Semester - III

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			Total
		Theory	Pract	Tut	Theory	Pract.	Tut.	
CEC301	Engineering Mathematics-III	3	-	1	3	-	1	4
CEC302	Mechanics of Solids	4			4			4
CEC303	Engineering Geology	3			3			3
CEC304	Architecture planning and Design of Building	2	-	-	2	-	-	2
CEC305	Fluid Mechanics- I	3	-	-	3	-	-	3
CEL301	Mechanics of Solids	-	2	-	-	1	-	1
CEL302	Engineering Geology	-	2	-	-	1	-	1
CEL303	Architectural Planning & Design of Buildings	-	2	-	-	1	-	1
CEL304	Fluid Mechanics- I	-	2	-	-	1	-	1
CEL305	Skill Based Lab Course-I		3		-	1.5		1.5
CEM301	Mini Project – 1 A	-	3 ^s	-	-	1.5	-	1.5
Total		15	14	1	15	7	1	23

Examination Scheme									
Course Code	Course Name	Internal Assessment			End Sem Exam	Exam Duration (Hrs.)-	Term Work	Prac. /Oral	Total
		Test I	Test II	Avg					
CEC301	Engineering Mathematics-III	20	20	20	80	3	25	-	125
CEC302	Mechanics of Solids	20	20	20	80	3	-	-	100
CEC303	Engineering Geology	20	20	20	80	3	-	-	100
CEC304	Architectural Planning & Design of Buildings	20	20	20	80	3	-	-	100
CEC305	Fluid Mechanics- I	20	20	20	80	3	-	-	100
CEL301	Mechanics of Solids	-	-	-	-	-	25	25	50
CEL302	Engineering Geology	-	-	-	-	-	25	25	50
CEL303	Architectural Planning & Design of Buildings	-	-	-	-	-	25	25	50
CEL304	Fluid Mechanics- I	-	-	-	-	-	25	25	50
CEL305	Skill Based Lab Course-I	-	-	-	-	-	50	-	50
CEM301	Mini Project – 1 A	-	-	-	-	-	25	25	50
	Total			100	400	-	200	125	825

CEC301 Engineering Mathematics-III

Course Code	Course Name	Credits
CEC 301	Engineering Mathematics-III	04

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

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem. Exam	Duration of End Sem. Exam	TW	PR	OR	
Test-I	Test-II	Average						
20	20	20	80	03 hrs	25	-	-	125

Pre-requisite: Engineering Mathematics-I,
Engineering Mathematics-II,

Course Objectives:

1. To familiarize with the Laplace Transform, Inverse Laplace Transform of various functions, its applications.
2. To acquaint with the concept of Fourier Series, its complex form and enhance the problem solving skills.
3. To familiarize with the concept of complex variables, C-R equations with applications.
4. To study the application of the knowledge of matrices and numerical methods in complex engineering problems.

Course Outcomes: Learner will be able to....

1. Apply the concept of Laplace transform to solve the real integrals in engineering problems.
2. Apply the concept of inverse Laplace transform of various functions in engineering problems.
3. Expand the periodic function by using Fourier series for real life problems and complex engineering problems.
4. Find orthogonal trajectories and analytic function by using basic concepts of complex variable theory.
5. Apply Matrix algebra to solve the engineering problems.
6. Solve Partial differential equations by applying numerical solution and analytical methods for one dimensional heat and wave equations.

Module	Detailed Contents	Hrs.
01	Module: Laplace Transform 1.1 Definition of Laplace transform, Condition of Existence of Laplace transform, 1.2 Laplace Transform (L) of Standard Functions like e^{at} , $\sin(at)$, $\cos(at)$, $\sinh(at)$, $\cosh(at)$ and t^n , where $n \geq 0$. 1.3 Properties of Laplace Transform: Linearity, First Shifting theorem, Second Shifting Theorem, change of scale Property, multiplication by t , Division by t , Laplace Transform of derivatives and integrals (Properties without proof). 1.4 Evaluation of integrals by using Laplace Transformation. Self-learning topics: Heaviside's Unit Step function, Laplace Transform. of Periodic functions, Dirac Delta Function.	07 Hrs.
02	Module: Inverse Laplace Transform 2.1 Inverse Laplace Transform, Linearity property, use of standard formulae to find inverse Laplace Transform, finding Inverse Laplace transform using derivative 2.2 Partial fractions method & first shift property to find inverse Laplace transform. 2.3 Inverse Laplace transform using Convolution theorem (without proof) Self-learning Topics: Applications to solve initial and boundary value problems involving ordinary differential equations.	06 Hrs.
03	Module: Fourier Series: 3.1 Dirichlet's conditions, Definition of Fourier series and Parseval's Identity (without proof) 3.2 Fourier series of periodic function with period 2π and $2l$, 3.3 Fourier series of even and odd functions 3.4 Half range Sine and Cosine Series. Self-learning Topics: Complex form of Fourier Series, orthogonal and orthonormal set of functions, Fourier Transform.	07Hrs.
04	Module: Complex Variables: 4.1 Function $f(z)$ of complex variable, limit, continuity and differentiability of $f(z)$, Analytic function, necessary and sufficient conditions for $f(z)$ to be analytic (without proof), 4.2 Cauchy-Riemann equations in cartesian coordinates (without proof) 4.3 Milne-Thomson method to determine analytic function $f(z)$ when real part (u) or Imaginary part (v) or its combination (u+v or u-v) is given. 4.4 Harmonic function, Harmonic conjugate and orthogonal trajectories Self-learning Topics: Conformal mapping, linear, bilinear mapping, cross ratio, fixed points and standard transformations	07Hrs.

05	Module: Matrices: 5.1 Characteristic equation, Eigen values and Eigen vectors, Properties of Eigen values and Eigen vectors. (No theorems/ proof) 5.2 Cayley-Hamilton theorem (without proof): Application to find the inverse of the given square matrix and to determine the given higher degree polynomial matrix. 5.3 Functions of square matrix 5.4 Similarity of matrices, Diagonalization of matrices Self-learning Topics: Verification of Cayley Hamilton theorem, Minimal polynomial and Derogatory matrix & Quadratic Forms (Congruent transformation & Orthogonal Reduction)	06 Hrs.
06	Module: Numerical methods for PDE 6.1 Introduction of Partial Differential equations, method of separation of variables, Vibrations of string, Analytical method for one dimensional heat and wave equations. (only problems) 6.2 Crank Nicholson method 6.3 Bender Schmidt method Self-learning Topics: Analytical methods of solving two and three dimensional problems.	06 Hrs.
	Total	39

Term Work:

General Instructions:

- 1 Batch wise tutorials are to be conducted. The number of student's per batch should be as per University pattern for practicals.
- 2 Students must be encouraged to write at least 6 class tutorials on entire syllabus.
- 3 A group of 4-6 students should be assigned a self-learning topic. Students should prepare a presentation/problem solving of 10-15 minutes. This should be considered as mini project in Engineering Mathematics. This project should be graded for 10 marks depending on the performance of the students.

The distribution of Term Work marks will be as follows –

1	Attendance (Theory and Tutorial)	05 marks
2	Class Tutorials on entire syllabus	10 marks
3	Mini project	10 marks

Assessment:

Internal Assessment for 20 marks: Consisting Two Compulsory Class Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour.

End Semester Examination: Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

- 1 Question paper will comprise of total six questions, each carrying 20 marks
- 2 Question 1 will be compulsory and should cover maximum contents of the curriculum
- 3 Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
- 4 Only Four questions need to be solved.

References:

- 1 Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication
- 2 Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited,
- 3 Advanced Engineering Mathematics, R. K. Jain and S.R.K. Iyengar, Narosa publication
- 4 Advanced Engineering Mathematics, H.K. Das, S. Chand Publication
- 5 Higher Engineering Mathematics B.V. Ramana, McGraw Hill Education
- 6 Complex Variables and Applications, Brown and Churchill, McGraw-Hill Education,
- 7 Text book of Matrices, Shanti Narayan and P K Mittal, S. Chand Publication
- 8 Laplace transforms, Murray R. Spiegel, Schaum's Outline Series

CEC302 - Mechanics of Solids

Semester-III								
Course Code			Course Name			Credits		
CEC302			Mechanics of Solids			4		
Contact Hours				Credits Assigned				
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total		
4	--		4	--	--	4		
Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem. Exam	Duration of End Sem Exam				
Test-I	Test-II	Average			TW	PR	OR	
20	20	20	80	3 Hours	--	--	--	

Rationale

Civil Engineering structures are made using various engineering materials such as steel, concrete, timber, other metals or their composites. They are subjected to force systems resulting into axial forces, bending moments, shear forces, torsion and their combinations. Different materials respond differently to these by getting deformed and having induced stresses. Determination of stress, and strain experienced by structural elements when subjected to diverse loads is prerequisite for an economical and safe design.

In this course, learners will understand the internal response behavior of material under different force systems. The knowledge of 'Mechanics of Structures' will be foundation of essential theoretical background for the courses like Structural Analysis and Structural Design.

Objectives

- 1) To compute the stresses developed and deformations of thin cylindrical shell and spherical shell subjected to internal pressure.

- 2) To learn to represent graphically the distribution of axial force, shear force and bending moment for statically determinate portal frames.
- 3) To study the circular shafts under the action of twisting moment.
- 4) To determine the principal planes and stresses.
- 6) To compute strain energy in elastic members.
- 6) To learn the general theorems.

Detailed Syllabus			
Module		Course Modules/Contents	Hours
1	Module Name-Stresses and strains in Thin Cylindrical and Spherical Shells		(03)
	1.1	Thin cylindrical shell subjected to internal pressure; determination of hoop stress, longitudinal stress, shear stress and volumetric strain.	2
	1.2	Thin spherical shell subjected to internal pressure; determination of hoop stress, shear stress and volumetric strain.	1
2	Module Name- Axial Force, Shear Force and Bending Moment Diagrams for Portal Frames		(06)
	2.1	Concept of Axial Force, Shear Force and Bending Moment.	02
	2.2	A.F., S.F. and B.M Diagrams for statically determinate 3-member simple Portal Frames without internal hinges.	04
3	Module Name- Torsion in Circular Shafts		(05)
	3.1	Torsion in solid and hollow circular shafts; shafts with varying cross sections.	3
	3.2	Shafts transmitting and receiving power at different points. Stresses in Shafts while transmitting power.	2
4	Module Name- Principal Planes and Stresses, Strain Energy		(08)
	4.1	General equation for transformation of stress, Principal planes and principal stresses, maximum Shear stress, stress determination by analytical and Graphical method (using Mohr's circle).	06
	4.2	Strain energy due to axial force and impact loads in columns, due to bending in beams, due to torsion of shaft.	02
5	Module Name- General Theorems		(03)
	5.1	General theorems: Betti's and Maxwell's reciprocal theorems, principle of superposition.	02
	5.2	Principle of virtual work, Castigliano's theorem.	01
Total Hours			25

Contribution to Outcome

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

- 1) Evaluate stresses and strains in thin cylindrical and spherical shells subjected to internal pressure.
- 2) Draw variation of axial force, shear force and bending moment diagram for statically

determinate portal frames.

- 3) Predict the angle of twist and shear stress developed due to torsion of circular shaft and compute power transmitted by the shaft.
- 4) Locate principal planes in members and calculate principal stresses using analytical and graphical method.
- 5) Calculate strain energy stored in the members due to elastic deformation.
- 6) Explain the general theorems.

Internal Assessment (20 Marks):

One **Compulsory Class Test**, based on approximately 40% of contents and another on 40% from the remaining content shall be conducted. Average of the two will be considered as IA Marks.

End Semester Examination (80 Marks):

Weightage of each module in end semester examination will be proportional to the number of respective hours mentioned in the curriculum.

- 1) Question paper will comprise of total **six questions, each carrying 20 marks.**
- 2) **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum.**
- 3) **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
- 4) **Totally Four questions** need to be **solved.**

Recommended Books:

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

Reference Books:

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

CEC303 - Engineering Geology

Course Code	Course Name	Credits
CEC303	Engineering Geology	4

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
3	2	-	3	1	-	4

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test-I	Test-II	Average						
20	20	20	80	3 Hours	25	-	25	50

Rationale

Engineering geology is an applied geology discipline that involves the collection, analysis, and interpretation of geological data and information required for the safe development of civil works. The objective of this course is to focus on the core activities of engineering geologists – site characterization, geologic hazard identification and mitigation. Through lectures, labs, and case study examination student will learn to couple geologic expertise with the engineering properties of rock in the characterization of geologic sites for civil work projects. Understanding of the foundation rocks and structures present in them is of utmost importance for the safety and stability of Civil engineering structures. The study also helps in the assessment of groundwater, oil and gas and mineral resource evaluation.

Objectives

1. To acquire basic knowledge of Geology and to understand its significance in various civil engineering projects.
2. To study minerals and rocks in order to understand their fundamental characteristics and engineering properties.
3. To study structural geology for characterization of site, analysis and report geologic data using standards in engineering practice.
4. To understand advantages and disadvantages caused due to geological conditions and assessment of site for the construction of civil structures.
5. To study the suitability of rock mass for the construction of tunnels and assessment of rock as source of ground water.
6. To study the control of geology over the natural hazards and their preventive measures.

Module		Course Modules / Contents	Periods
1		Introduction & Physical Geology	3
	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	Weathering and its types, engineering consideration of weathering	
2		Mineralogy and Petrology	5
	2.1	Identification of minerals with the help of physical properties, rock forming minerals, study of common ore minerals.	
	2.2	Igneous Petrology - Mode of formation, Texture (Equigranular, Porphyritic, Poikilitic, Intergrowth), Structure (Flow structure, vesicular and amygdaloidal structure) Classification (depth wise and classification based on silica percentage), Engineering aspect of Granite and Basalt.	
	2.3	Sedimentary Petrology - Mode of formation, Textures, Structures (lamination, bedding, current bedding), classification, and engineering consideration of sedimentary rocks.	
	2.4	Metamorphic Petrology - Mode of formation, agents and types of metamorphism, classification (Foliated and non-foliated) and engineering consideration of metamorphic rocks.	
3		Structural Geology and Stratigraphy	5
	3.1	Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Fold: Terminology, Classification on the basis of position of axial plane and engineering consideration of folds. Fault: Terminology, Classification on the basis of movement of faulted block and Engineering consideration of faults. Joints & Unconformity: Types and geological importance.	
	3.2	Determination of thickness of the strata with the help of given data.	
	3.3	General principles of Stratigraphy.	
4		Geological Investigation, study of dam and reservoir site:	3
	4.1	Required geological consideration for selecting dam and reservoir site. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions.	
	4.2	Rock Quality Designation and its importance to achieve safety and economy of the projects like dams and tunnels.	
5		Tunnel Investigation and Ground Water Control	3
	5.1	Importance of geological considerations while choosing tunnel sites and alignments of the tunnel, safe and unsafe geological and structural conditions.	
	5.3	Sources, zones, water table, unconfined, confined and Perched water tables. Factors controlling water bearing capacity of rocks, Cone of Depression and its use in Civil engineering.	

6	Geological Disasters and Control Measures		2
	6.1	Landslides-Types, causes and preventive measures for landslides.	
	6.2	Volcano- Central type and fissure type, products of volcano.	
	6.3	Earthquake- Causes, Terminology, Earthquake waves, and Preventive measures for structures constructed in Earthquake prone area.	

Contribution to Outcome

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

- Explain the concepts of Geology and its application for safe, stable and economic design of any civil engineering structure.
- Interpret the lithological characters of the rock specimen and distinguish them on the basis of studied parameters.
- Describe the structural elements of the rocks and implement the knowledge for collection and analysis of the geological data.
- Interpret the geological conditions for the dam site and calculate RQD for the assessment of rock masses.
- Analyze the given data and assess tunneling and groundwater conditions.
- Interpret the causes of geological hazards and implement the knowledge for their prevention.

Internal Assessment (20 Marks):

Consisting **Two Compulsory Class Tests**

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination (80 Marks):

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of total **six questions, each carrying 20 marks.**
2. **Question 1** will be **compulsory** and should **cover maximum contents of the curriculum**
3. **Remaining questions will be mixed in nature** (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only **Four questions need to be solved.**

Recommended Books:

1. Text book of Engineering Geology: N. Chenna, Kesavulu, Mc-Millan.
2. Text book of Engineering and General Geology, 8th edition (2010): Parbin Singh, S K Kataria & Sons.
3. Text book of Engineering Geology: P. K. Mukerjee, Asia.
4. Text book of Engineering Geology: Dr. R. B. Gupta, Pune Vidyarthi Griha Prakashan, Pune.

5. Principles of Engineering Geology: K. M. Banger.

Reference Books:

1. A Principles of Physical Geology: Arthur Homes, Thomas Nelson Publications, London.
2. Structural Geology, 3rd edition (2010): Marland P. Billings, PHI Learning Pvt. Ltd. New Delhi
3. Earth Revealed, Physical Geology: David McGeeary and Charles C. Plummer
4. Principles of Geomorphology: William D. Thornbury, John Wiley Publications, New York.
5. Geology for Civil Engineering: A. C. McLean, C.D. Gribble, George Allen & Unwin London.
6. Engineering Geology: A Parthsarathy, V. Panchapakesan, R Nagarajan, Wiley India 2013.

CEC304 - Architectural Planning & Design of Buildings

Course Code	Course Name	Credits
CEC304	Architectural Planning & Design of Buildings	02

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
02	-	-	02	-	-	02

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test-I	Test-II	Ave						
20	20	20	80	3 Hours	-	-		100

Rationale

Drawing is the language of Civil Engineers to communicate. 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

- 1) To remember and recall the intricate details of building design and drawing.
- 2) To gain an understanding of the basic concepts of building design and drawing.
- 3) To learn how to apply professional ethics and act responsibly pertaining to the norms of building design and drawing practices, rules, regulation and byelaws, Building codes

- 4) To identify, analyze, research literature and solve complex building design and drawing problems.
- 5) To have new solutions for complex building design and drawing problems.
- 6) To effectively communicate ideas, related to building design and drawing, both orally as well as in written format like reports & drawings.

Course Outcomes

At the end of the course learners will be able to:

1. Students will be able to design and draw plans, elevations and sections of public buildings
2. Students will be able to draw foundation plans and roof plans
3. Students will be able to draw perspective drawings
4. Students will be able to explain town planning
5. Students will be able to explain green buildings
6. Students will be able to summarize an overview of CAD

Modules	Sub-Modules/Contents	Periods
1.	Principles and Codes of Practice for Planning and Designing of Buildings	5
1.1.	Study of National Building Code of India 2016: a) Classification of Buildings b) Development Control Rules (for Public Buildings)	
1.2.	Principles of Planning of Public Buildings (School or Hospital)	
1.3.	Planning and Designing of Public Buildings (School or Hospital)	
1.4.	Sun Path Diagram, Wind Rose Diagram and Sun Shading Devices	
1.5.	Principles of Architectural Planning	
2.	Components of Buildings	2
2.1.	Types of Foundations and Foundation Plan	
2.2.	Types of Roofs and Roof Plan (for flat roof only)	2
3.	Perspective Drawings	
3.1.	Introduction to Perspective Drawings	2
3.2.	Two Point Perspective Drawing	
4.	Town Planning	2
4.1.	Objectives and Principles of Town Planning	
4.2.	Master plan, Redevelopment of Buildings, Slum Rehabilitation	1
5.	Green Buildings	
5.1.	Introduction and Overview	3
5.2.	Green Building Rating System – LEED, TERI, GRIHA, IGBC (any one)	
6.	Computer Aided Drawing	3
6.1	Introduction and Overview of any one professional CAD software	
6.2	Study and demonstration of any one of the professional CAD software's	

Theory Examination:

- 1) Only 4 questions (out of 6) need to be attempted.
- 2) Question no. 1 will be compulsory and based on the drawing work of any one building, may be residential or public building.. Some questions from the remaining may be on Theory portion.

- 3) 4. 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.

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-I) will be conducted in the mid of the semester based on the 50% of the syllabus. It will be of 20 marks. Similarly, the second internal assessment (IA-II) will be conducted at the end of the semester and it will be based on next 50% 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. Civil Engineering Drawing (including Architectural aspect) by *M. Chakraborti* (Monojit Chakraborti Publications, Kolkata)

Recommended Books

- 1) Planning and Designing Buildings by Y. S. Sane (Modern Publication House, Pune)
- 2) Building Drawing and Detailing by B.T.S. Prabhu, K.V. Paul and C. V. Vijayan (SPADES Publication, Calicut)
- 3) 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>)
- 4) Development Control Regulations for Navi Mumbai Municipal Corporation – 1994 (<https://www.nmmc.gov.in/development-control-regulations>)
- 5) Development Plan and Control Regulation KDMC, <https://mmrda.maharashtra.gov.in>

Reference Codes:

- 1) National Building Code of India, 2005
- 2) IS 779-1978 Specification for Water Meter
- 3) IS 909-1975 Specification for Fire Hydrant
- 4) IS 1172-1983 Code of Basic Requirement for Water Supply, Drainage & Sanitation
- 5) IS 1742-1983 Code of Practice for Building Drainage

CEC305 - Fluid Mechanics- I

Course Code		Course Name				Credits
CEC305		Fluid Mechanics - I				03
Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
3	-	-	03	-	-	03

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test-I	Test-II	Average						
20	20	20	80	03 Hours	-	-	-	100
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, hydrokinematics and hydrodynamics with their applications in fluid flow problems.

Objectives

The students will be able to learn:

1. The properties & types of fluids, units and dimensions
2. Principle of buoyancy and stability of floating body
3. Kinematic and Dynamic behavior through various laws of fluids like continuity, Euler's, Bernoulli's equations.
4. Importance of fluid flow and various velocity measuring and discharge measuring devices.
5. The basic difference between in-compressible and compressible flow, Propagation of pressure waves and stagnation points.

Detailed Syllabus

Module		Course Modules / Contents	Periods
1		Properties of Fluids -	02
	1.1	Types of fluids, and introduction to real life applications.	
2		Buoyancy and flotation:	04
	2.1	Archimedes principle, Meta-Centre, metacentric height, Stability of floating and submerged bodies, determination of metacentric height, Experimental and analytical methods, metacentric height for floating bodies containing liquid.	
3		Fluid Kinematics	06
	3.1	Types of fluid flow, description of flow pattern, Lagrangian methods, Eulerian method, continuity equation, velocity and	

		acceleration of fluid particles. Stream line, Equipotential line, flow net and its uses.	
4	Fluid Dynamics		06
	4.1	Forces acting on fluid in motion, Navier Stokes Equation, Euler's Equation of motion, Integration of Euler's equations of motion, Bernoulli's Theorem (Numerical Only), Practical applications of Bernoulli's Equation to Venturimeter, Orifice meter, pitot tube.	
5	Compressible flow		04
	5.1	Basic equation of flow (elementary study), velocity of sound or pressure wave in a fluid, Mach number, propagation of pressure waves, area-velocity relationship, Stagnation properties.	

Contribution to Outcome

Upon completion of the course, students shall have ability to:

- 1) Describe various properties of fluids and types of flow
- 2) Determine the pressure difference in pipe flows, application of Continuity equation and Bernoulli's theorem to determine velocity and discharge
- 3) Apply hydrostatic and dynamic solutions for fluid flow applications
- 4) Analyse the stability of floating bodies
- 5) Apply the working concepts of various devices to measure the flow through pipes and channels
- 6) Explain the compressible flow, propagation of pressure waves and stagnation properties

Internal Assessment (20 Marks):

Consisting Two Compulsory Class Tests:

First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)

End Semester Examination (80 Marks):

Weightage of each module in end semester examination will be proportional to number of respective lecture hours mentioned in the curriculum.

- 1) Question paper will comprise of total **six questions, each carrying 20 marks.**
- 2) **Question 1** will be compulsory and should **cover maximum contents of the curriculum**
- 3) **Remaining questions will be mixed in nature**(for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
- 4) Only **Four questions need to be solved.**

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. Subramanian, Tata McGraw hill publishing company, New Delhi.

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

Reference Books:

- 1) Fluid Mechanics: Frank M. White, Tata McGraw Hill International Edition.
- 2) Fluid Mechanics: Streeter White Bedford, Tata McGraw International Edition.
- 3) Fluid Mechanics with Engineering Applications: R.L. Daugherty, J.B. Franzini, E.J. Fennimore, Tata McGraw 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.

Civil Engineering Semester – III -LAB

CEL301 - Mechanics of Solids

Semester- III						
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Course Code	Course Name	Credits
CEL301	Mechanics of Solids- LAB	01

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
-	02	-	-	01	-	01

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test-I	Test-II	Average						
-	-	-	-	-	25	-	25	50

Objectives

- 1) To learn stress - strain behavior and physical properties of materials and to compute the stresses developed and deformation of elastic members.
- 2) To study circular shafts under the action of twisting moment.
- 3) To study the bending stresses induced in the specimen.
- 4) To learn about the compressive strength of an engineering material.

Outcomes

Learner will be able to...

- 1) Evaluate stress - strain behaviour of materials and assess the structural behaviour by the virtue of stresses developed and deformation of elastic members.
- 2) Analyze the material response under the action of flexure (bending).
- 3) Predict the angle of twist and shear stress developed due to torsion.
- 4) Evaluate the compressive strength of a specimen.

Term Work: Term work comprises of Laboratory work and assignments.

Laboratory Work: CEL301

Mechanics of Solids (Practical Performance)		
Experiment No.	Name of the Experiment	Duration (Hours)
1	Tension test on circular Mild Steel rod	02
2	Compression test on timer block	02
3	Pure bending test on timber beam.	02
4	Torsion test on circular mild steel specimen	02

Assignments:

At least 1 assignment from each module as per the course instructor's guidelines is to be written. It is to be assessed during the laboratory hours. In order to avoid Copying/ repetition, course instructor may give different assignments to different groups.

Mechanics of Solids		
Assignment No.	Name of the Assignment	Duration (Hours)
1	Stresses and strains in Thin Cylindrical and Spherical Shells	02
2	Axial Force, Shear Force and Bending Moment Diagrams for Portal Frames	02
3	Torsion in Circular Shafts	02
4	Principal Planes and Stresses, Strain Energy	02
5	General Theorems	

Important Websites:

- 1) [http://www.iitk.ac.in/mseold/mse_new/facilities/laboratories/Material Testing Lab / MSE313A.pdf](http://www.iitk.ac.in/mseold/mse_new/facilities/laboratories/Material_Testing_Lab/MSE313A.pdf)
- 2) [https://home.iitm.ac.in/kramesh/Strength of Materials Laboratory Manual.pdf](https://home.iitm.ac.in/kramesh/Strength%20of%20Materials%20Laboratory%20Manual.pdf)
- 3) https://www.researchgate.net/publication/338139499_Me_8381-Strength_Of_Materials_Lab_Manual

Assessment:

- **Term Work**

Including both the Laboratory Work and Assignments, distribution of marks for Term Work shall be as follows:

Laboratory work: 15 Marks

Assignments: 10 Marks

The sum will be multiplied by a factor of attendance between 0.5 (for poor attendance) to 1 (very good attendance).

- **End Semester Oral Examination**

Oral examination will be based on the entire syllabus.

CEL302 - Engineering Geology

Course Code	Course Name	Credits
CEL302	Engineering Geology Lab. Practice	1

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
-	2	-	-	1	-	1

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test-I	Test-II	Average						
-	-	-	-		25	-	25	50

Objectives

Objectives:

- To acquire basic knowledge of Geological Lab practices and apply it for the safe development of Civil Engineering works.
- To examine the mineral and identify their physical properties.
- To examine the rock sample and understand their fundamental properties for their evaluation as construction and foundation material.
- To Study the drilling data and calculate RQD for assessment of rock masses for Civil Engineering purposes.

Outcomes: Learner will be able to...

- Identify various rock forming minerals on the basis of physical properties.
- Explain the characteristics of Igneous, Sedimentary and Metamorphic rocks and assess their suitability as construction material and foundation rock.

- Interpret the rock characteristics and comment on their suitability as water bearing horizons.
- Calculate RQD and evaluate the rock masses for Civil Engineering Works.

A) List of Experiments

Module	Detailed Contents	Lab Sessions /Hr
1	Study of Physical Properties of Minerals: Identification of common Rock forming minerals on the basis of physical Properties- Silica Group: Quartz and its varieties; Cryptocrystalline silica: Jasper and Agate; Feldspar Group: Orthoclase, Plagioclase; Carbonate Group: calcite;	2
2	Amphibole Group: Asbestos, Actinolite and Hornblende; Pyroxene Group: Augite; Mica Group: Muscovite, Biotite and Talc; Element Group: Graphite. Identification of Metallic minerals: Galena, Pyrite, Hematite, Magnetite.	2
3	Identification of rocks: Igneous Rocks- Granite and its varieties, Basalt and its varieties	2
4	Sedimentary Rocks- Conglomerate, Breccia, Sandstone, Shales, Limestones, Laterites.	2
5	Metamorphic Rocks- Schist, Gneiss, Slate, Marbles and Quartzite.	2
6	Calculation of RQD from the given data and assessment of rock quality.	2

B) Assessment:

● Term Work

Including Laboratory Work and Assignments both, Distribution of marks for Term Work shall be as follows:

Laboratory work-	:	10 Marks
Assignments-	:	10 Marks
Attendance	:	05 Marks

● End Semester Oral Examination

Pair of Internal and External Examiner should conduct Oral examination.

CEL303 - Architectural Planning & Design of Buildings

Course Code	Course Name	Credits
CEL 303	Architectural Planning & Design of Buildings	01

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
-	02	-	-	01	-	01

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test-I	Test-II	Average						
-	-	-	-	-	25	-	25	50

@ For the course ‘Architectural Planning & Design of Buildings, the oral examination shall be conducted in conjunction with the sketching examination.

Rationale

Drawing is the language of Civil Engineers to communicate. 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.

Course Outcomes for Practicals

1. Students will be able to design and draw plans, elevations and sections of public buildings
2. Students will be able to draw foundation plans and roof plans
3. Students will be able to draw perspective drawings

Sr. No.	Practical	Periods
1	i) Developed plans, ii) elevation and iii) section (passing through staircase and one sanitary unit) of (G+1) Public Buildings - RCC Framed Structure	3
2	i) Foundation Plan and ii) Roof Plan of (G+1) Public Buildings - RCC Framed Structure	1
3	Two – Point Perspective	2

Practical Examination (Oral and Sketching)

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

Term Work:

Drawings:

- 1) Ground floor plan, first floor plan, elevation, section passing through at least one sanitary unit & staircase, Site plan, Foundation Plan and details of one FOOTING, Roof Plan, schedule of opening and construction notes of a **public building** to be constructed as a (G+1) R.C.C. framed structure (**only Manual Drawing**)
- 2) **Foundation Plan and Roof Plan** of Sheet 1
- 3) **Two-Point Perspective Drawing**

Assignment: Short notes on theory topics of syllabus (green building, town planning etc.)

Distribution of Term-work Marks:

The marks of term-work shall be judiciously awarded depending upon the quality of the term work. The final certification acceptance of term-work warrants the satisfactorily the appropriate completion of the required quality & quantity of work for 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.

	Particulars	Marks
1	Drawing Sheet (Manual)	15 Marks
2	Assignments	5 Marks
3	Attendance	5 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 (**Consider**

Practical attendance)

Recommended Books:

- Building Drawing with an Integrated Approach to Built Environment by *M. G. Shah, C. M. Kale, S.Y. Patki*(Tata McGraw-Hill Education)
- Civil Engineering Drawing (including Architectural aspect) by *M. Chakraborti* (MonojitChakraborti Publications, Kolkata)
- Planning and Designing Buildings by *Y. S. Sane* (Modern Publication House, Pune)
- Building Drawing and Detailing by *B.T.S. Prabhu, K.V. Paul and C. V. Vijayan* (SPADES Publication, Calicut)
- Building Planning by *Gurucharan Singh* (Standard Publishers & Distributors, New Delhi)

References:

- IS 962: 1989 – Code of Practice for Architectural and Building Drawings.
- National Building Code of India – 2005 (NBC 2005)
- Development Control Regulations for Mumbai Metropolitan Region for 2016 – 2036 (<https://mmrda.maharashtra.gov.in>)
- Development Control Regulations for Navi Mumbai Municipal Corporation – 1994 (<https://www.nmmc.gov.in/development-control-regulations>)
- Development Plan and Control Regulation KDMC, <https://mmrda.maharashtra.gov.in>

Reference Codes:

- National Building Code of India, 2016
- IS 779-1978 Specification for water meter
- IS 909-1975 Specification for fire hydrant
- IS 1172-1983 Code of basic requirement for water supply ,drainage & sanitation
- IS 1742-1983 code of practice for building drainage

CEL304 - Fluid Mechanics- I

Semester- III						
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Course Code	Course Name	Credits
CEL304	Fluid Mechanics – I (Lab)	01

Contact Hours			Credits Assigned			
Theory	Practical	Tutorial	Theory	Practical	Tutorial	Total
-	02	-	-	01	-	01

Theory					Term Work/Practical/Oral			Total
Internal Assessment			End Sem Exam	Duration of End Sem Exam	TW	PR	OR	
Test-I	Test-II	Average						
-	-	-	-	-	25	-	25	50

Course Objectives:

The students will be able to learn:

1. The basic fluid mechanics concepts
2. Measuring pressure, velocity and discharge of fluid flow through pipes and channels

Course Outcomes:

At the end of the course, learner will be able to:

1. Calculate the metacentric height
2. Verify the Bernoulli's theorem
3. Determine the discharge coefficients
4. Measure fluid flow using various devices
5. Determine the hydraulic coefficients of an orifice

Module	Detailed Contents	Lab Sessions/ Hr
1	Determination of the Metacentric height of a floating body	2
2	Determination of coefficient of discharge of Venturimeter.	2
3	Determination of coefficient of discharge of Orifice meter.	2
4	Determination of coefficient of discharge of Notches (Rectangular and Triangular notch).	2
5	To determine the value of coefficient of contraction, coefficient of velocity and coefficient of discharge for the given orifice	2

Assessment:

Term Work

Including Laboratory Work and Assignments both, Distribution of marks for Term Work shall be as follows:

Laboratory work	:	15 Marks
Assignments	:	05 Marks
Attendance	:	05 Marks

End Semester Oral Examination

Oral examination will be based on entire syllabus.

Reference Books:

- Fluid Mechanics and Hydraulic Machines: R. K. Rajput, S. Chand and Company
- Hydraulics and Fluid mechanics: Dr.P.M. Modi and Dr. S.M. Seth, Standard Book House, Delhi
- Hydraulics Fluid Mechanics and Fluid Machines: S. Ramamrutham, DhanpatRai Publishing Company (P) Ltd-New Delhi
- Theory and Application of Fluid Mechanics: K. Subramanian, Tata McGraw hill publishing company, New Delhi.
- Fluid Mechanics and Hydraulics: Dr. S.K. Ukarande, Ane's Books Pvt. Ltd. (Revised Edition 2012), ISBN 97893 8116 2538
- Fluid Mechanics and fluid pressure engineering: Dr. D.S. Kumar, F.K. Kataria and sons
- Fluid Mechanics: R.K. Bansal Laxmi Publications (P) Ltd.

NOTE –

1: For Detailed Course Schemes, Course Objectives, Internal & External Assessment process, End Semester Examination, Recommended & reference Books please refer MU syllabus of Second year (C-Scheme / R-19) Civil Engineering.

2: Theory and Practical Examination will be strictly based on above compressed syllabus.